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# RESOURCES ABSTRACTS

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SELECTED WATER RESOURCES ABSTRACTS is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the National Technical Information Service (NTIS), U.S. Department of Commerce. NTIS was established September 2, 1970, as a new primary operating unit under the Assistant Secretary of Commerce for Science and Technology to improve public access to the many products and services of the Department. Information services for Federal scientific and technical report literature previously provided by the Clearinghouse for Federal Scientific and Technical Information are now provided by NTIS.

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# SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Resources Research, U.S. Department of the Interior



**VOLUME 5, NUMBER 3** FEBRUARY 1, 1972

W72-01121 -- W72-01690

WATER RESOURCES ABSTRACTS

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

#### FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the Water Resources Thesaurus. Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCU-MENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

Supplementary documentation is being secured from established disciplineoriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the

Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center Office of Water Resources Research U.S. Department of the Interior Washington, D. C. 20240

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ABSTRACT SOURCES

#### SELECTED WATER RESOURCES ABSTRACTS

#### **01. NATURE OF WATER**

#### 1B. Aqueous Solutions and Suspensions

THE EFFECT OF HERBICIDES, PESTICIDES, AND FERTILIZERS ON THE OPTICAL PRO-

PERTIES OF WATER,
Missouri Univ., Kansas City. Dept. of Physics.
Marvin R. Querry, and Richard C. Waring. Marvin R. Querry, and Richard C. Waring. Available from National Technical Information Service as PB-204 814, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, Aug 13, 1971. 84 p., 10 fig, 30 ref, 2 append. OWRR A-030-MO

Descriptors: \*Infrared radiation, \*Aqueous solu-Descriptors: "intrared radiation," Aqueous sout-tions, Herbicides, Fertilizers, Pesticides, "Optical properties, Water analysis, "Analytical techniques, Pollutant identification, Potassium compounds, Ammonium compounds, "Spectrophotometry, Identifiers: "Reflectance spectra, Reflectometers.

The relative infrared reflectances of aqueous solutions of K2SO4, NH4H2PO4, and (NH2)2CO were measured for radiant flux incident at about 70 deg. Distilled water was the reflectance standard. The absolute reflectances of the aqueous solutions were computed by using the relative reflectances, one of the Fresnel equations, and the optical constants of water. The optical constants of the solutions were computed by applying a Kramers-Kronig analysis to the absolute reflectances spectra. The relative reflectances, absolute reflectances and optical conspectral signatures characteristic of the solute are discussed. stants are presented in graphical and tabular form; W72-01334

THERMODYNAMIC PROPERTIES OF BRINE, Oklahoma State Univ., Stillwater. Dept. of

Mechanical Engineering.

A. M. Elgawhary, and A. M. Rowe.

Available from the National Technical Information Service as PB-204 497, \$3.00 in paper copy, \$0.95 in microfiche. Oklahoma Water Resources Research Institute, Stillwater, Completion Report, Nov 1, 1971. 53 p, 4 append. OWRR A-019-OKLA

Descriptors: \*Thermal pollution, Mathematical models, \*Brines, Water pollution control, Aqueous solutions, \*Thermal properties, Water tempera-ture, Spraying, Heated water. Identifiers: \*Spray cooling, \*NaCl solutions, Pure

water, Staging.

The objectives were two-fold: (1) to determine experimentally the therodynamic properties of salt solutions, and (2) to use these properties to develop a mathematical model to evaluate spray pond cooling of fresh water or brine as a means of controlling thermal pollutions. Correlations were developed to predict the thermodynamic proper-ties of NaCl solutions. Procedures were developed to measure secondary effects on properties of two salt solutions. The properties of NaCl solutions were used in the prediction of decrease in liquid temperature by spray cooling either hot water or hot NaCl solutions for a range of weather condi-W72-01341

C13 AND O18 COMPOSITIONS IN SOME FRESH-WATER CARBONATES ASSOCIATED WITH ULTRAMAFIC ROCKS AND SERPEN-TINITES: WESTERN UNITED STATES,

Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 02K. W72-01522

CALCIUM-MAGNESIUM CARBONATE SOLID SOLUTIONS FROM HOLOCENE CON-

GLOMERATE CEMENTS AND TRAVERTINES IN THE COAST RANGE OF CALIFORNIA, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 02K. W72-01523

#### 02. WATER CYCLE

#### 2A. General

REGRESSION ANALYSIS OF NONLINEAR CATCHMENT SYSTEMS, Auckland Univ. (New Zealand). Dept. of Civil En-

Water Resources Research, Vol 7, No 5, p 1118-1126, October 1971. 3 fig, 2 tab, 12 ref.

Descriptors: \*Rainfall-runoff relationships, \*Simulation analysis, \*Mathematical models, \*Regression analysis, \*Statistical models, Routing, Unit hydrographs, Input-output analysis, Systems analysis, Time series analysis, Streamflow forecasting, Synthetic hydrology.

Catchments may be considered to be nonlinear systems with rainfall input and streamflow output. These systems are analyzed by using a discrete form of the nonlinear convolution integrals in con-junction with stepwise multiple regression to obtain a prediction equation from rainfall and streamflow records. The analytical techniques employed have practical applications in the continuous simulation of complex catchment behavior. Two rural catchments were modeled to verify the methods and the results were satisfactory. (Knapp-USGS) W72-01122

ADEQUACY OF MARKOVIAN MODELS WITH CYCLIC COMPONENTS FOR STOCHASTIC STREAMFLOW SIMULATION,

Instituto Venezolano de Investigaciones Cientificas, Caracuas

I. Rodriquez-Iturbe, D. R. Dawdy, and L. E. Garcia.

models.

Water Resources Research, Vol 7, No 5, p 1127-1143, October 1971. 9 fig, 5 tab, 16 ref.

\*Statistical models, \*Stochastic Descriptors: processes, \*Markov processes, \*Mathematical models, \*Rainfall-runoff relationships, Simulation analysis, Time series analysis, Synthetic hydrology, Correlation analysis, Statistical methods. Identifiers: Stochastic hydrology, Stochastic

Deterministic hydrologic cycles may not exist from physical and statistical points of view. The spectra of streamflow series vary with time, and this variation suggests the nonstationary character of the data. Demodulation techniques were used to study the statistical character of the amplitude and phase of the annual streamflow cycle. The use of the results may be used in models for simulation. A case study was performed with several Markovian-type models. The seasonal variation in the standard deviation should be incorporated in any model used for design. The type of distribution used for the random component does not have a great influence on streamflows generated for storage design. Great care should be taken when using logarithmic models because they may produce very distorted synthetic traces when improperly used. (Knapp-USGS) W72-01123

AN AUTOMATIC SOLUTION FOR THE IN-VERSE PROBLEM,

Ecole Nationale Superieure des Mines de Paris, Fontainbleau (France). Lab. of Mathematical Hydrogeology. For primary bibliographic entry see Field 02F. W72-01137

A MODEL FOR THE SIMULATION OF STREAMFLOW DATA FROM CLIMATIC

Monash Univ., Clayton (Australia). Dept. of Civil

Engineering.
J. W. Porter, and T. A. McMahon.
Journal of Hydrology, Vol 13, No 4, p 297-324,
September 1971. 12 fig, 2 tab, 38 ref.

Descriptors: \*Rainfall-runoff relationships, \*Simulation analysis, \*Mathematical models, Computer programs, Infiltration, Interception, Routing, Percolation, Groundwater movement, Evapotransp Identifiers: Australia

A digital computer model of the rainfall-runoff process operates on a time interval of one day or one hour. The model attempts to synthesize the component processes into a system with a high degree of physical correspondence to the catchment situation. It is intended for use in an encatchment situation. It is intended for use in an engineering context and employs Philip's infiltration theory, a nonlinear catchment routing procedure, and nonlinear groundwater storages. Evapotranspiration is estimated using Mcliroy's combination or evaporimeter data. The Dandenong Creek (Victoria, Australia), is gaged at Dandenong. It incorporates areas of the developing urban sprawl of eastern Melbourne. A direct comparison of recorded and simulated flows was made for three sample years, including the best (1960) and the sample years, including the best (1960) and the worst (1957) obtained. The correlation coefficient of daily flows for this period was 0.77 and for monthly flows the correlation coefficient was 0.87. Slightly higher correlation coefficients have been obtained at the expense of the objective function. (Knapp-USGS)
W72-01147

'OROHYDROGRAPHIC INCONSISTENCIES' IN THE RELIEF OF THE SOVIET FAR NORTHEAST OROGIDROGRAFICHESKIKH NESOGLASIYAKH' V REL'YEFE KRAYNEGO SEVERO-VOSTOKA SSSR),

A. A. Navmark. Description of the strain of t

Descriptors: \*Geomorphology, \*Orography, \*Topography, Geologic time, Recent epoch, Pleistocene epoch, Quaternary period, Drainage, Glaciation, Erosion, Land subsidence, Mountains, Valleys, Watersheds (Basins), Terraces (Geological), Arctic Ocean, Pacific Ocean, Identifiers: \*USSR, \*Soviet Far East, \*Orohydrog-bachtersheds, Pacific Ocean, Pacific Oce raphy, Drainage Peneplains, Uplift. networks, Reconstruction,

The geomorphological literature on the Soviet Far East frequently describes situations which may be termed 'orohydrographic inconsistencies,' which relate, in some cases, to the unconformable superresate, in some cases, to the unconformable super-position of the present-day drainage network on an older one and, in other cases, to large orographic elements such as mountain ranges and massific Four types of orohydrographic discrepancies were described: (1) Late Pleistocene and Holocene captures in areas of the main watershed dividing the Arctic and Pacific Ocean basins, as illustrated by capture in the upper reaches of the Chernaya River; (2) Holocene reconstructions associated with the unconformable superposition of a drainage network on a vacated relief following the melting of glaciers, as seen in the postglacial recon-struction of the drainage network in upper reaches of the Pegtymel' and Palyavaam rivers; (3) reconstructions associated with an uplifted and dissected structions associated with an uplifted and dissected Eopleistocene peneplain, as evidenced by the dissection of an old valley in the Northern Anyuy Range by more youthful valleys; and (4) antecedent valley areas developed from an uplifted and deformed pre-Pliocene peneplain as exemplified by the crossing of the Penzhina Range by the Talovka River. (Josefson-USGS) W72.01158 W72-01159

#### Group 2A-General

STUDY OF SWAMP BIOCOENOSES, (IN RUS-

SIAN), N. I. P'Yavchenko, and A. A. Nitsenko, and M. S.

Izv Akad Nauk Sssr Ser Biol. 4. 553-561. 1970 En-

glish summary. Identifiers: Aeration, Biocoenoses, Formation, Moisture, Peat, Soil, Swamp.

Owing to their metabolism and energy specificity swamps should be regarded as remote representa-tives of dry ground biocenoses comparable to water s. Some swamps are related to the latter since they form due to gradual overgrowth of water. Swamp biogeocoenoses are primarily determined by an excess of moisture and poor soil aeration, and dominance of hydro- and hydrophytic plants usually characterized by layers of peat. The formation of swamps is regarded as a complicated internally contradictive process, based on the inter-relation and non-biological factors.--Copyright 1971, Biological Abstracts, Inc. W72-01286

INSTANTANEOUS UNIT HYDROGRAPH ANAL VSIS OF HAWAIIAN SMALL WATERSHEDS,

Hawaii Univ., Honolulu. Water Resources Research Center.

For primary bibliographic entry see Field 02E. W72-01375

#### INTRODUCTION TO PHYSICAL HYDROLO-

Methuen and Co., Ltd., Chorley, R. J., ed., (University Paperback 406), London, England, 1971.

Descriptors: \*Water resources development, \*Hydrologic cycle, Geomorphology, Precipitation (Atmospheric), Evapotranspiration, Soil moisture, Infiltration, Throughfall, Overland flow, Ground-water movement, Open channel flow, Snow, Ice, Glaciers, Floods, Hydrograph analysis, Streamflow, Climatology. Identifiers: \*Geography.

The theme of this book is that the study of water provides a logical link between an understanding of physical and social environments. Each chapter develops this theme by proceeding from the many aspects of water occurrence to a deeper un-derstanding of natural environments and their fusion with the activities of man in society. In this way water is viewed as a highly variable and mobile resource in the widest sense. Not only is it a com-modity which is directly used by man but it is often the mainspring for extensive economic developthe mainspring for extensive economic develop-ment, commonly an essential element in man's aesthetic environment which provides the stage for his activities. The subjects discussed include: the world hydrological cycle; the basin hydrological cy-cle; the drainage basin as the fundamental geomorphic unit; precipitation; the assessment of precipitation; evaporation and transpiration; soil moisture: infiltration, throughflow, and overland moisture; infiltration, throughflow, and overland flow; groundwater; open channel flow; the hydrology of snow and ice; the flood hydrograph; river regimes; and long-term precipitation trends. (See also W72-01434 thru W72-01443) (Knapp-USGS) W72-01433

#### GROUND WATER,

Colorado State Univ., Fort Collins. Dept. of Geolo-

gy. J. P. Waltz.

In: Introduction to Physical Hydrology, Methuen and Co., Ltd., (University Paperback 406), London, England, p 122-130, 1971. 3 fig, 1 tab, 6 ref.

Descriptors: \*Groundwater, \*Hydrology, \*Groundwater movement, \*Hydrogeology, Geology, Aquifers, Aquifer characteristics, Structural geology, Sediments, Particle size, Porosity, Permeability, Topography, Hydrologic budget, Confined water, Perched water, Darcys law, Hydrologic cycle Hydrologic cycle.

Groundwater is water which occurs beneath the surface of the earth within saturated zones where the hydrostatic pressure is equal to or greater than atmospheric pressure. The volume of water which can be held within earth materials is controlled by the porosity of the materials. Porosity is usually ex-pressed as a decimal fraction or as a percentage. For example, a rock specimen which contains pores or open spaces equal to one-fourth the total volume of the specimen would have a porosity of 25%. In granular sediments, porosity is not directly affected by the size of the grains, but is affected by the uniformity of size, the shape, and the packing characteristics of the grains. The ease with which water can move through earth materials is a funcwater can move through earth materials is a tun-tion of the permeability of the materials. The permeability of granular earth materials is greatly affected by the size of grains as well as by the shape, packing, and uniformity of size of grains. Permeability can be expressed as a rate of discharge per unit area (e.g. gallons/day/sq. ft.) under controlled hydraulic conditions. Porosities and permeabilities for geologic materials are tabulated. Groundwater flow velocities in nature may vary in the extreme from several feet per second to less than a foot per year. The normal rate of flow of groundwater is probably between 5 ft/yr and 5 ft/day. (See also W72-01433) (Woodard-USGS) W72-01434

#### THE WORLD HYDROLOGICAL CYCLE,

Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.

In: Introduction to Physical Hydrology, Methuen and Co., Ltd., (University Paperback 406), London, England, p 8-26, 1971. 10 fig, 6 tab, 23 ref.

Descriptors: \*Hydrologic cycle, \*Hydrologic budget, \*Water balance, \*Earth (Planet), Precipitation (Atmospheric), Evaporation, Condensation, Runoff, Surface waters, Ground Oceans, Glaciers, Climatology, Snowmelt, Water vapor, Hydrology, Water circulation, Atmosphere,

The exchanges of water involved in the various stages of the hydrological cycle are evaporation, moisture transport, condensation, precipitation, and runoff. These components are examined on a global basis. The interdependence of the various components of the hydrological cycle makes it apparent that a change in any climatic parameter may have far-reaching repercussions. For instance, a 1% nave tar-reaching repercussions. For instance, a 1% increase in evaporation from the tropical oceans would cool a 200-m layer by 3 degrees C in fifty years. It is estimated that at the Quaternary glacial maximum-the Illinoian, Riss, or Saale glacial - ice affected an area 3 times that of the present ice cover with 5 times the present mass. Different calculations of ice volume indicate a lowering of 159 culations of ice volume indicate a lowering of 159 m during the Illinoian maximum. The actual sealevel change in the glacierized areas was complicated by the isostatic depression of the continents due to their ice load. As climate started to ameliorate towards the end of the last glacial period the increased runoff from the melting icecaps caused an eustatic rise in sea level. This is considered to have begun about 18,000 years ago, when sea level was some 105-120 m below the present level, and proceeded rapidly until about 6,000 years ago. (See also W72-01433) (Woodard-W72-01435

#### THE BASIN HYDROLOGICAL CYCLE,

Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering. R. J. More.

In: Introduction to Physical Hydrology, Methuen and Co., Ltd., (University Paperback 406), London, England, p 27-36, 1971. 3 fig, 8 ref.

Descriptors: \*River basins, \*Hydrology, \*Hydrologic cycle, \*Water balance, \*Watersheds (Basins), Precipitation (Atmospheric), Evapora-tion, Runoff, Evapotranspiration, Water storage, Streamflow, Surface waters, Groundwater, Model studies, Analytical techniques, Analog models, Systems analysis, Computer programs, Hydrologic budget.

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The components of the basin hydrological cycle and the relationships between them are described and the relationships between them are described in five main ways: by natural analogs, hardware models, synthetic systems, partial systems, and the 'black box' approach. The river-basin cycle is viewed as inputs of precipitation distributed through a number of storages by a series of transfers, leading to outputs of basin channel runoff, evapotranspiration, and deep outflow of groundwater. The gross operation of the basin hydrological cycle may be approximated as: Precipitationcal cycle may be approximated as: Precipitation— Basin channel runoff .. Evapotranspiration .. Changes in storage. (See also W72-01433) (Woodard-USGS) W72-01436

#### THE ASSESSMENT OF PRECIPITATION,

Institute of Hydrology, Wallingford (England).

In: Introduction to Physical Hydrology, Methuen and Co., Ltd., (University Paperback 406), London, England, p 77-81, 1971. 2 fig, 4 ref.

Descriptors: \*Precipitation (Atmospheric), \*Rain-Descriptors. Technation (Atmosphere), Rain-fall, \*Rain gages, Reviews, Instrumentation, Rain-fall disposition, Equipment, Methodology, Hydrologic data, Data collections. Identifiers: \*Precipitation assessment.

The transformation of point measurements of rainfall into an estimate of the mean for an area can be carried out in several ways. Where gages are evenly distributed over an area and relief is subdued, use can be made of the arithmetic mean. The construction of Thiessen' polygons around each gage would record weight according to the area of the polygon around it. This method is objective by contrast with the isohyetal and isopercentile techniques, which are largely subjective. One other method is the use of regression analysis, but this is only successful in regions where topography controls the distribution of rain. The error in determining the mean rainfall for an area is appreciable, even when the most satisfactory instruments are combined with the best technique of network design and computation of the mean. Where snow is important this error will be even greater. (See also W72-01433) (Woodard-USGS) W72-01437

#### PRECIPITATION,

Colorado Univ., Boulder. Inst. of Arctic and Alpine

R. G. Barry

In: Introduction to Physical Hydrology, Methuen and Co., Ltd., (University Paperback 406), London, England, p 60-76, 1971. 6 fig, 3 tab, 34 ref.

\*Precipitation (Atmospheric), Precipitation (Atmospheric), \*Hydrology, Snow, Rain, Hail, Sleet, Climatology, Cloud physics, Condensation, Cyclones, Storms, Precipitation intensity, Rainfall disposition, Orog-

The major categories of precipitation include: Dew, Fog-drip, Drizzle, Rain, Sleet, Snowflakes, Dew, Fog-drip, Drizzle, Rain, Sleet, Snowflakes, Snowgrains, Snow pellets, Ice pellets, and Hail. Three main types of precipitation, according to the mode of uplift to the air, include: (a) 'Convective type' precipitation, (b) 'Cyclonic type' precipitation, and (c) Orographic precipitation. In the strict sense orographic precipitation implies that precipitation occurs over high ground when none is falling on the surrounding plains. More frequently, it is a component of the total precipitation resulting from the effect of orography on the basic converfrom the effect of orography on the basic convec-tive and cyclonic mechanisms. The effect is depen-dent on the size of the barrier and its alignment with respect to the wind. Over narrow uplands the horizontal scale may be insufficient for maximum cloud buildup, and precipitation may be carried over the crest-line by the wind, causing a lee-side maximum. In middle and higher latitudes where

onshore westerlies are forced to rise sharply over constal mountains precipitation may increase with height up to 2,000 m (6,500 ft) or more. A widespread, perhaps even global, characteristic of rainfall is the occurrence of most of the annual total on a few days. Half of the annual precipitation is accounted for by 13% of the rain days in the Kenya Rift Valley, 16% in the basin of the upper Colorado River, and 10-15% in Argentina. At Con-Cotorado Kiver, and 10-15% in Argentina. At Con-cord, New Hampshire, 6% of the rain days gave 23% of the total precipitation during 1885-1935. This characteristic seems to be independent of the precipitation regime, annual total, and geographi-cal location. (See also W72-01433) (Woodard-USGS) W72-01438

EVAPORATION AND TRANSPIRATION, Colorado Univ., Boulder. Inst. of Arctic and Alpine

In: Introduction to Physical Hydrology, Methuen and Co., Ltd., (University Paperback 406), London, England, p 82-97, 1971. 8 fig, 21 ref.

Descriptors: \*Evaporation, \*Evapotranspiration, \*Water balance, \*Hydrologic cycle, \*Hydrology, Humidity, Latent heat, Water vapor, Solar radiation, Temperature, Atmosphere, Kinetics, Climates, Meteorology, Vegetation, Topography, Soil moisture, Mathematical studies, Analytical techniques, Hydrologic budget.

Net transfer of water molecules into the air occurs only if there is a vapor-pressure gradient between the evaporating surface and the air, i.e. evaporation is nil when the relative humidity of the air is 100%. be missing the control of the missing the water requires of and can be a source must therefore be available. This may be solar radiation, sensible heat from the atmosphere, or from the ground. Alternatively, it may be drawn from the kinetic energy of the water molecules, thus cooling the water until equilibrium with the atmosphere is established and evaporation ceases. In general, solar radiation is the principal energy ource for evaporation. The evaporation rate also is affected by wind speed, since air movement carries fresh unsaturated air to the evaporating surface. Within approximately 1 mm of the surface the upward movement of vapor is by individual molecules ('molecular diffusion'), but above this surface boundary layer turbulent air motion ('eddy diffusion') is responsible. The temperature of the evaporating surface also affects evaporation. At higher temperatures more water molecules can leave the surface due to their greater kinetic energy. Salinity depresses the evaporation rate in proportion to the solution concentration. For sea water the rate is about 2-3% lower than for fresh water. (See also W72-01433) (Woodard-USGS) W72-01439

#### THE HYDROLOGY OF SNOW AND ICE, Michigan Univ., Ann Arbor. Dept. of Geography. M. G. Marcus.

In: Introduction to Physical Hydrology, Methuen and Co., Ltd., (University Paperback 406), London, England, p 153-161, 1971. 5 fig, 5 ref.

Descriptors: \*Hydrology, \*Snow, \*Ice, \*Hydrologic budget, \*Glaciers, Water balance, Hydrologic data, Climates, Hydrologic cycle, Glacial drift, Lakes, Oceans, Water sources, Frost, Hail, Melt water, Snowfall, Water equivalent, Mass transfer.

Snow and ice are significant elements of the world hydrological system. Snow and ice are present in the atmosphere, in lakes and rivers and oceans, on the land, and even beneath the earth's surface. Sometimes their appearance is brief and local, as in the sudden snow flurry or the hailstorm. In other places snow and ice dominate the earth's surface. In recent geological time - some 10,000-20,000 years ago - continental glaciers covered about 32% of the earth's land surface. Much of that ancient ice has receded and disappeared, yet some 10% of the land surface remains covered by glaciers, while 7% of the ocean surface is coated by pack or sea ice at their maximum winter extent. An additional 22% of the earth's land surface is underlain by zones of the carth's land surface is underlain by zones of permanently frozen ground. Seasonal snow coats the continents throughout the mid-latitudes; and even at the Equator, the higher mountain summits are capped by snow and ice. Over 99% of glacier ice is found in Antarctica, Greenland, and islands of the Arctic Archipelago. In principle, the seasonal snow cover responds to energy and moisture fluxes as do glaciers. Inputs and outputs determine the mass budget, and the only distinctions are in scale and time. (See also W72-01433) (Woodard-USGS) W72-01440

#### THE FLOOD HYDROGRAPH,

Institute of Hydrology, Wallingford (England). J. C. Rodda.

In: Introduction to Physical Hydrology, Methuen and Co., Ltd., (University Paperback 406), London, England, p 162-175, 1971. 5 fig, 14 ref.

Descriptors: \*Floods, \*Hydrographs, \*Streamflow, \*Design flood, \*Model studies, Hydrology, Hydrologic cycle, Hydrologic budget, Base flow, Peak discharges, Precipitation (Atmospheric), Water balance, Runoff, Topography, Vegetation, Flood forecasting, Flood control.

Where the quantity of runoff from a river basin is measured continuously, a graph of flow as a func-tion of time is obtained. This discharge hydrograph expresses the sequence of relationships that o between runoff and the other components of the basin water balance, together with their adjustments to the physical characteristics of the basin. A precise method of predicting the size and shape of precise method of predicting the same simple the flood hydrograph is invaluable to the hydrolo-gist for flood-warning purposes and for providing the basic information for the design of spillways, culverts, bridges, and similar structures. Some floods are caused by dam bursts, earth movements, and high tides, but these are rare by comparison the floods due to intense rain or rapid snow melt. In the case of rain-induced floods the path of the storm in relation to the alignment of the basin, the size of the storm, and its rate of movement are important, as well as the intensity and amount of rain. Once the rain has reached the surface of the basin, the rate and amount of runoff will be influenced by such factors as the current evaporation and infiltration rates, the soil moisture status, and the type of land use. Several model concepts for flood hydrographs are described. (See also W72-01433) (Woodard-USGS).

Oxford Univ. (England). School of Geography. R. P. Beckinsale.

In: Introduction to Physical Hydrology, Methuen and Co., Ltd., (University Paperback 406), London, England, p 176-192, 1971. 6 fig, 27 ref.

Descriptors: \*Rivers, Regime, \*Streamflow, \*Streamflow forecasting, Hydrologic data, Hydro-\*Streamflow, graphs, Channel morphologic data, Hydro-graphs, Channel morphology, Hydrology, Hydrologic cycle, Precipitation (Atmospheric), Runoff, Topography, Vegetation, Evaporation, Seepage, Water balance, Hydrologic budget, River basins, Water yield.

The regime of a river is defined as the variations in the river's discharge and is portrayed by a curve based on regular observations. Seasonal variations in the natural runoff of a drainage basin depend primarily on the relationships between climate, vegetation, soils and rock structure and, to a lesser extent, basin size can be strictly independent of cli-mate. The river regimes of small and moderately sized basins may closely reflect regional runoff controls. The main watercourses of many large and complex basins often acquire regimes unrepresen-tative of the territory they are crossing. The lower Colorado and lower Nile are examples. There are, however, such large areas of the world within which local and regional river regimes reflect the regional climatic rhythm that some form of areal differentiation into river-regime types is desirable. Hydrological regions have been identified recently for Italy, France, and West Africa. This areal dif-ferentiation will progress in accuracy and coverage ferentiation will progress in accuracy and coverage as hydrological observations increase, and will, without the need for extrapolation, eventually be without the need for extrapolation, eventually be based entirely on local measurements, showing the influence of both regional climatic and non-climatic factors on runoff. It will also be possible to distinguish all rivers with regimes markedly different from that of the hydrological region they are crossing. (See also W72-01433) (Woodard-USGS). W72-01442

#### LONG-TERM PRECIPITATION TRENDS,

Colorado Univ., Boulder. Inst. of Arctic and Alpine

In: Introduction to Physical Hydrology, Methuen and Co., Ltd; (University Paperback 406), London, England, p 193-203, 1971. 5 fig, 1 tab, 22 ref.

Descriptors: \*Precipitation (Atmospheric), \*Hydrology, \*Time series analysis, \*Frequency analysis, \*Hydrologic data, Statistical methods, Hydrologic cycle, Rain, Snow, Hail, Sleet, Cli-matology, Rainfall disposition, Earth (Planet), Hydrographs, Distribution patterns, Hyetographs, Average. Identifiers: \*Precipitation trends.

The simplest method for determining long-term precipitation trends is the calculation of a running mean where mean values are determined for successive, overlapping periods of five, ten, or thirty years. An important feature of the space and time scales of climatic fluctuations is the tendency for short-term fluctuations to be of mainly local nificance, whereas longer-lasting changes affect a wider area. For example, the 1939-44 drought in southeast Australia was apparently local, but the protracted dry conditions in eastern Australia during 1896-1915 also affected other east-coast and tropical regimes. It is possible that the essential difference between recent fluctuations and those of glacial-interglacial scale is one of increased duraglacial-intergracial scale is one of intereased designation rather than greater magnitude of change, although 'feedback effects' between the atmosphere and oceans may perpetuate the initial change. In the tropics there seems to have been a shorter wet season associated with a narrowing of the intertropical convergence zone. The subtropical high-pressure cells apparently intensified and expanded both polewards and equatorwards, while cyclones in the westerlies of the northern hemi-sphere tended to shift northward. This represents a more zonal circulation, a tendency which has reversed since about 1940. (See also W72-01433) (Woodard-USGS). W72-01443

STUDY AND UTILIZATION OF THE WATER RESOURCE OF THE USSR, 1966-1967, (IZUCHENIYE I ISPOL-ZOVANIYE VODNYKH RESURSOV SSSR, 1966-1967 GG).
Akademiya Nauk SSSR, Moscow. Inst. of Water

Research

Izdatel'stvo 'Nauka', Moscow, Kuznetsov, I. A., editor-in-chief, 1970. 189 p.

Descriptors: \*Abstracts, \*Projects, Descriptors: "Abstracts, "Projects, "Water resources, "Water resources development, "Water management (Applied), Project planning, Water balance, Water requirements, Water supply, Drainage, Irrigation, Hydrogeology, Groundwater, Runoff, Water pollution control, Waste water (Pollution), Reservoirs, Regulation, Hydraulic structures. Identifiers: \*USSR, \*Water research, \*Water

#### Group 2A-General

This is a collection of 163 abstracts of papers prepared by research institutes, planning agencies, and educational establishments of the USSR engaged in conducting basic research in water resources and in studying water-resources problems. The collection is designed to familiarize scientific workers specializing in hydrology with current hydrologic research projects to promote the development of theoretical hydrology and a program of water research. The abstracts are grouped according to the direction of development and utilization of water resources: (1) study of the demands placed upon water resources by various branches of the national economy; (2) study of the quantitative and qualitative characteristics of water resources; (3) study of the principles for quantitative redistribution and qualitative transformation of water resources; (4) study of the movement of water masses and their interaction with the environment; and (5) study of methods for constructing multiple-purpose water management projects. The collection covers essentially the hydrologic papers and articles prepared in 1966-67, although some text materials completed and published dur-ing this period have not been included. (Josefson-USGS) W72-01549

#### 2B. Precipitation

MODEL FOR THE SIMULATION OF STREAMFLOW DATA FROM CLIMATIC RECORDS.

Monash Univ., Clayton (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W72-01147

ICE CRYSTALS AND SOLAR HALO DISPLAYS, PLATEAU STATION, 1967, Arctic Inst. of North America, Washington, D.C.

For primary bibliographic entry see Field 02C. W72-01173

THE ANTARCTIC ICE SHEET AND ITS PROBABLE BI-MODAL RESPONSE TO CLI-

California Univ., Berkeley. Dept. of Geography. For primary bibliographic entry see Field 02C. W72-01176

CLIMATIC CAUSES OF ALPINE GLACIER FLUCTUATION, SOUTHERN VICTORIA LAND.

Kansas Univ., Lawrence. Dept. of Geology. For primary bibliographic entry see Field 02C. W72-01177

SNOW ACCUMULATION ON THE FIMBUL ICE SHELF, WESTERN DRONNING MAUD LAND, ANTARCTICA, Geological Survey of South Africa, Pretoria. An-

For primary bibliographic entry see Field 02C.

SEA ICE: ANTARCTIC ASPECTS.

W72-01180

Melbourne Univ. (Australia). Dept. of Meteorology. For primary bibliographic entry see Field 02C. W72-01191

THE THERMAL BALANCE OF SEA ICE AT HALLEY BAY. British Meteorological Office, Bracknell (En-

gland). For primary bibliographic entry see Field 02C. W72-01192

CLIMATIC DATA FOR 1969 OF THE HIGH METEOROLOGICAL STATIONS GENEVA REGION, (IN FRENCH),

Conservatoire Botanique, Geneva (Switzerland). P. Hainard, J. Miege, and O. Monthoux. Candollea. 25 (2): 229-234. 1970. (English sum-

Identifiers: Climatic, Geneva, High, Meteorological, Stations, Switzerland.

Within the framework of the program undertaken by the Conservatoire botanique of Geneva since 1967, the data for 1969 from 6 meterological out-posts are presented.—Copyright 1971, Biological Abstracts, Inc. W72-01193

RAINFALL PATTERN AND MONTHLY FORAGE YIELDS IN THAL RANGES OF PAKISTAN,

Pakistan Forest Inst., Peshawar. For primary bibliographic entry see Field 03F. W72-01212

THE ASSESSMENT OF PRECIPITATION, Institute of Hydrology, Wallingford (England). For primary bibliographic entry see Field 02A. W72-01437

PRECIPITATION,

Colorado Univ., Boulder. Inst. of Arctic and Alpine Research. For primary bibliographic entry see Field 02A. W72-01438

RESEARCH PROGRESS REPORT-1970: PAN-HANDLE RESEARCH STATION, GOODWELL, OKLAHOMA

Oklahoma State Univ., Goodwell. Panhandle Experiment Station.
For primary bibliographic entry see Field 03F.
W72-01444

THE CHINESE MONSOON, Hawaii Univ., Honolulu. Dept of Geography.

Jen-hu Chang. Geographical Review, Vol. 61, No 3, p 370-395, July 1971. 7 fig, 64 ref.

Descriptors: Descriptors: \*Monsoons, Synoptic analysis, \*Meteorological data, \*Cyclones, \*Air circulation, Anti-cyclones, Typhoons, Advection, Air mass Atmosphere, Fronts (Atmospheric), Weather data, Atmospheric pressure, Cold regions, Distribution patterns, Precipitation (Atmospheric), Storm structure, Temperature, Winds, Latitudinal studies, Weather patterns. Identifiers: \*China.

Weather changes in China are rapid and often unpredictable. In the postwar years, a large amount of data has been accumulated and analyzed. This paper is an attempt at a synthesis of these studies. Circulation patterns at both the surface and 500-mb level and meridional cross-sections along 120 deg E are presented for January and July. In January, the mean sea-level pressure map in East Asia is dominated by an anti-cyclone centered over Mon-golia. The cold waves and cyclonic disturbances that develop in winter are related to the zonal in-dex, a widely used circulation intensity indicator that is the average isobaric difference between the latitudinal circles of 35 degrees and 55 degrees for some or all longitudes. Winter rainfall is derived principally from 3 synoptic systems: the moving upper-air troughs, the wave cyclones and the shearlines. The Mai-yu weather is the monsoon sea June and July, which largely originates in the Bay of Bengal with the strongest current near 750 mb. Rainfall distribution depends on the blocking situation to the north. Thus the circulation pattern which leads to floods in one part of east China may lead to summer droughts in another and vice vers The synoptic systems are discussed in detail. Various systems involved in early spring and high autumn crisp weather are also discussed. There is a growing realization that the moonsoon circulation growing realization that the monison circulation is a far more complex and a far less self-contained system than the classical concept of differential heating between land and ocean had led us to believe. (Casey-Arizona) W72-01449

MESO-SYSTEMS IN THE ATMOSPHERE, Queen Mary Coll. (England). Dept. of Geography. B. W. Atkinson.
Canadian Geographer, Vol 14, No 4, p 286-308, 1970. 13 fig, 42 ref.

Descriptors: \*Air circulation, \*Atmospheric pressure, \*Meteorological data, \*Fronts (Atmospheric), \*Precipitation (Atmospheric), Convection, Topography, Orography, Cake breezes, Seabreezes, Snowfall, Winds, Air masses, Weather forecasting. Identifiers: \*Mesosystems (Atmospheric).

In terms of horizontal dimensions, there are 4 con-In terms of horizontal dimensions, there are 4 constituent motion systems in the general atmospheric circulation. The mesosystem lies within the 15-150 km size range, which is within a kinetic energy minimum over the 10-500 km range. Analysis of meteorological elements as a prerequisite for synoptic forecasting is limited to absolute necessities and consequently many smaller atmospheric circulations are often eliminated as random fluctuations on the synoptic scale. Therefore, little tuations on the synoptic scale. Therefore, little background information on the smaller systems has been available. This paper reviews the recent literature on observation, description and theory of at-mospheric mesosystems. They are observed by a few surface and upper-air networks of close mesh, radar, lidar, aircraft and satellites. There are 3 types of recognized mesosystems: (1) topographically induced systems, which are causes of lee waves and lee depressions, wake eddies and sea and lake breezes; (2) free atmospheric convective and associated systems, including various types of convection cells, leading to such phenomena as synop-tic squall-lines; (3) free atmosphere non-convective systems, which involve snowfall, frontal structures, and other phenomena. Brief descriptions are given of various mesoscale rainfall patterns. The limited theoretical work is viewed in the context of lee waves, sea breezes and frontal precipitation. (Casey-Arizona) W72-01453

ON THE QUESTION OF THE EXISTENCE OF SINGULARITIES IN THE SUMMER RAINFALL OF THE SOUTH AFRICAN MAIZE GROWING REGION.

Weather Bureau, Pretoria (South Africa). For primary bibliographic entry see Field 03F. W72-01464

POTENTIAL SOLAR RADIATION CLIMATES

OF MAN, California Univ., Los Angeles. Dept. of Geography. W. H. Terjung, and S. Louie. Annals, Association of American Geographers, Vol-61, No. 3, p. 481-500, September 1971. 13 fig, 7 tab, 30 ref.

Descriptors: \*Solar radiation, \*Climatic data, \*Model studies, \*Energy exchange, \*Latitudinal studies, Physiological ecology, Heat exchange, Theoretical analysis, Estimating equations, Cooling, Evaporation, Convection, Conduction.
Identifiers: \*Bioclimatology, Global radiation, Ver-

The science of energy balance climatology has been primarily concerned with energy and mass interchanges at inorganic interfaces. Additionally, most solar radiation data are concerned only with horizontal surfaces. Organic interfaces are mainly vertically oriented and involve extremely complicated energy exchange patterns. Input and output sides of the energy balance equation are

tical objects.

#### Snow, Ice, and Frost-Group 2C

cussed for organisms and a deterministic system of models is developed for shortwave radiation under cloudless conditions; actual conditions are compared with ideal standards. The investigations compared with ideal standards. The investigations are enlarged to a latitudinal range. A number of important results emerged: (1) Each latitude has a unique daily variation of direct beam solar radiation on man, ranging from biomodal daily curves to bell-shaped curves; (2) the daily direct solar radiation in lower latitudes is relatively low for low sun perioda; (3) latitudes 73-80 degrees potentially receive the highest noontime input on earth; (4) latitudes undergo great fluctuations in daily radiation sums on man excepting 0-30 degrees, which are stable; (5) the largest potential energy inputs occur at the poles between May and July; (6) the direct solar radiation on man relative to that on a horizontal interface shows great seasonal and spahorizontal interface shows great seasonal and spa-tial change; (7) during most of the year, man's total solar heat load is affected by albedo only in the low latitudes; (8) except in summer, direct solar radia-tion at above sea level relative that at sea level increases exponentially from the equator to higher latitudes. (Casey-Arizona) W72-01468

INFORMATION GUIDE TO AN INFORMATION GUIDE TO HYDROMETEOROLOGICAL INSTRUMENTS AND OBSERVATION METHODS (INFORMAT-SIONNYYE MATERIALY PO GIDROMETEOROLOGICHESKIM PRIBORAM I METODAM NABLYUDENIY). MATERIALY Scientific Research Inst. of Hydrometeorological Instruments, Moscow (USSR).

Gidrometeoizdat, Moscow, Khomenko, Ya. N., editor-in-chief, NIIGMP Collection 43, 1970. 73 p.

Descriptors: \*Meteorology, \*Instrumentation, \*Specifications, \*Patents, \*Measurement, Water measurement, Water levels, Analytical techniques, Research and development, Telemetry, Hydrography, Hygrometry, Precipitation gages, Soil moisture meters, Hydrometers, Anemometers, Current meters, Thermometers, Radiosondes, Radar

Identifiers: \*USSR, Comecon, Sensors, Telethermometers, Psychrometers, Pyrgeometers, Hyp-someters, Wind vanes, Fli-flops, Thermoanemome-

This collection contains a brief description of a large number of new hydrometeorological instrularge number of new hydrometeorological instru-ments designed to measure air temperature, pres-sure and humidity, wind direction and velocity, precipitation, snowfall, water levels, water discharges, velocity of flowing water, etc. Efficien-cy suggestions made by workers associated with central and regional establishments of the Main Administration of the Hydrometeorological Ser-vice of the USSR were directed at the improvement of various instrument components. Descriptions of of various instrument components. Descriptions of Soviet inventions are accompanied by Russian-lan-guage abstracts of journal articles on patented in-ventions appearing in the non-Soviet literature on hydrometeorology, including abstracts of papers on hydrometeorological instruments being manufac-tured by member countries of the Soviet bloc trade group (Comecon). (Josefson-USGS) W72-01550

#### 2C. Snow, Ice, and Frost

EVALUATION OF SNOW WATER EQUIL-VALENT BY AIRBORNE MEASUREMENT OF PASSIVE TERRESTRIAL GAMMA RADIA-

National Weather Service, Silver Spring, Md.
For primary bibliographic entry see Field 07B.
W72-01125

RUNOFF PROCESSES DURING SNOWMELT. Agricultural Research Service, Danville, Vt. T. Dunne, and R. D. Black. ater Resources Research, Vol 7, No 5, p 1160-1172, October 1971. 9 fig, 5 tab, 7 ref.

Descriptors: "Snowmelt, "Runoff, "Infiltration, "Soil water movement, "Base flow, Hydrographs, Runoff forecasting, Storm runoff, Frost, Solar radiation, Temperature, Topography, Small watersheds, Vermont, Precipitation (Atmosphere), Painful watersheds, Vermont, Precipitation (At Rainfall-runoff relationships.
Identifiers: Sleepers River Experimental Watershed

During the snowmelt period of 1967, snowmelt ru-noff from three pastured plots was measured as it moved to the stream channel over the ground sur-face, through the topsoil, and through the phreatic zone. Because of the presence of a thin layer of concrete frost in the normally porous topsoil, the infiltration capacity of the soil was reduced to a very low value. Almost one-half of the meltwater left the plots as overland flow. Discharge rates, total volumes, and timing of this portion of the ru-noff were strongly controlled by incoming shorttotal volumes, and timing of this portion of the norff were strongly controlled by incoming short-wave radiation. The response of subsurface flow to melting was heavily damped by storage and transmission of water in the soil. Combined daily hydrographs of runoff were dominated by overland flow. mission of water in the soil. Combined daily hydro-graphs of runoff were dominated by overland flow. Comparison of the timing of such hydrographs with concurrent stream channel hydrographs from basins of the Sleepers River Experimental Watershed suggests that overland flow was a major control of the diurnal fluctuations of streamflow. Previous studies in the same area have demonstrated that much of the overland flow contributing to the responsive stream hydrographs of these basins originates on saturated areas of the watershed. (Knapp-USGS) W72-01126

EFFECT OF A FREEZING ZONE OF FINITE WIDTH ON THERMAL REGIME OF SOILS Cold Regions Research and Engineering Lab.,

Hanover, N.H. Y. Nakano, and J. Brown. Water Resources Research, Vol 7, No 5, p 1226-1233, October 1971. 4 fig, 4 tab, 19 ref.

Descriptors: \*Freezing, \*Frozen soils, \*Soil physics, Frost, Thermodynamics, Mathematical models, Ice, Soil water, Soil moisture, Melting,

Identifiers: Freezing zone (Soils).

Soils may be classified into two types in terms of their freezing characteristics: (1) granular soil, in which pores are comparitively large and almost all the water freezes at the freezing point of water to form a freezing front, and (2) soil with fine pores, of clay, in which some water remains unfrozen at the freezing zone. For soils having a very thin freezing zone, the concept of an imaginary freezing zone is introduced for computational simplicity. The computational method based on such a concept is sufficiently accurate for practical applications. For all practical purposes is assumed that the content of unfrozen water in frozen soil is determined by the temperature. (Knapp-USGS) W72-01133

AN ECONOMICAL DEVICE FOR OPTICALLY DETECTING SNOW DEPTH AT REMOTE STA-

Utah State Univ., Logan. Dept. of Soil Science and Biometeorology.

I. Dirmhirn, and C. Craw.

Water Resources Research, Vol 7, No 5, p 1328-1332, October 1971. 5 fig, 7 ref.

Descriptors: \*Telemetry, \*Snowpacks, \*Snowfall, \*Precipitation gages, \*Snow surveys, Data collections, Water equivalent, Monitoring, Optical properties, Opacity.
Identifiers: \*Snow depth recorder, \*Snow gages.

An instrument that automatically records remote snow depth consists of an optically monitored silicon cell ladder and an electronics panel with a diode pump to generate yes/no signals of 0 or 2 volts. This system with minor adaptions can be integrated into any telemetering system. Records for one snowmelt situation are presented. In addition to snow depth, the record provides a method of determining the density and time of snowfall or rate of melt for a given time based on the slope of the curve derived from the graph of snow accumula-tion or snowmelt. Both the accumulation and the settling of snow can be observed with this device. (Knapp-USGS) W72-01139

ICE CRYSTALS AND SOLAR HALO DISPLAYS. PLATEAU STATION, 1967, Arctic Inst. of North America, Washington, D.C. M. Kuhn.

In: International Symposium on Antarctic Glaciological Exploration (ISAGE), Hanover, N H, September 3-7, 1968; International Association of Scientific Hydrology Publication 86, p 298-303, 1970. 1 fig, 1 tab, 6 ref.

Descriptors: \*Snow, \*Ice, Crystals, \*Optical properties, \*Clouds, Haze, Light intensity, Opacity, Snowfall, Precipitation (Atmospheric). Identifiers: Solar halos, Cirrus clouds.

From December 1966 through January 1968 an extensive micrometerological program was operated at Plateau Station, Antarctica, at an elevation of 3625 m. Net accumulation and surface density 3022 m. Net accumulation and surface density measured in this connection were 9.1 cm snow per year at 0.30 g/cc in 1967. Of all positive contributions to the net accumulation, the substantial part is made up by precipitation of ice prisms from cirrus clouds or from cloudless skies. This ice crystal precipitation was observed on 317 days in 1967, with frequency maying in series and fell. with frequency maxima in spring and fall (every day) and minima in January (14 days) and June (23 days). The intensity varied from an intermit-tent fall of single crystals to strong uniform precipitation that could decrease atmospheric transparency by 8 percent. Six main crystal types were recognized, four of which contributed to the formation of solar halo phenomena. Each type is as-sociated with a certain temperature range. (See also W72-00817) (Knapp-USGS) W72-01173

A STUDY ON DRIFTING SNOW,

Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science. ra, and D. Kobayashi.

In: International Symposium on Antarctic Glaciological Exploration (ISAGE), Hanover, N H. September 3-7, 1968; International Association of Scientific Hydrology Publication 86, p 303-308, 1970. 5 fig, 1 ref.

Descriptors: \*Snow, \*Snowpacks, \*Sediment transport, \*Saltation, Winds, Photography, Temperature, Bed load, Movement, Antarctic. identifiers: Snow drifting.

As part of an investigation aiming to explain the relation between temperature and threshold wind speed for snow drifting, the behavior of snow parti-cles was studied by still and high speed cine photog-raphy. No evidence was found of any surface creep or suspension in the lowest 10 cm above the snow surface where saltation appears to be the sole mode of snow transport by the wind. (See also W72-00817) (Knapp-USGS)

THE ANTARCTIC ICE SHEET,

P. A. Shumsky. In: International Symposium on Antarctic in: international symposium on Antarcute Glaciological Exploration (ISAGE), Hanover, N H, September 3-7, 1968; International Association of Scientific Hydrology Publication 86, p 327-347, 1970. 9 fig. 2 tab, 17 ref.

Descriptors: \*Glaciers, \*Ice, \*Antarctic, \*Reviews, Regimen, Glaciation, Water balance, Velocity, Strain, Shear, Shear stress, Surveys, Rheology, Identifiers: \*Antarctic ice sheet.

#### Group 2C-Snow, Ice, and Frost

The most important results of the analysis of glaciological data published up to 1966 are reviewed. Dimensions form, and regime of the An-tarctic ice sheet are characterized. Distributions of velocity, strain rate, shear stress, temperature, rate of melting at the bottom, and of the age of ice are computed for a stationary axi-symmetrical model of the ice sheet. The average diameter of the Antarctic Ice Sheet is 3934 km. It has a minimum diameter of 2900 km and a maximum diameter of 5600 km. The volume of land based ice in Antarctica, assuming an average bottom level of 410 m, is 23.0 million cu km. For the whole continental ice sheet the total accumulation rate is 2168 cu km of water per year. One half of all the accumulation is received by a coastal zone 260 km wide, and only one quarter by the central region with radius of 1400 km which represents more than one half of the entire continental ice sheet area. The average turnover period of the ice in a continental ice sheet and, therefore, the average age of ice in steady state conditions is equal to 9.55 to 12.60 thousand years. The age of the ice grows with the depth according to a logarithmic law. The oldest ice occurs on the bottom at the boundary melting. If this boundary is located at 1400 km from the center then the ice there must reach an age of about 466,000 years. In reality this figure may be higher, due to the absence of bottom sliding when temperatures are below freezing. (See also W72-00817) (Knapp-USGS) W72-01175

THE ANTARCTIC ICE SHEET AND ITS PROBABLE BI-MODAL RESPONSE TO CLI-MATE,

California Univ., Berkeley. Dept. of Geography. M. B. Giovinetto

International Symposium on Antarctic Glaciological Exploration (ISAGE), Hanover, N H, September 3-7, 1968; International Association of Scientific Hydrology Publication 86, p 347-358, 1970. 2 fig, 2 tab, 21 ref. NSF - GA-245.

Descriptors: \*Glaciers, \*Antarctic, \*Water balance, \*Hydrologic budget, \*Regimen, Snowfall, Ablation, Movement. Identifiers: Mass balance.

Net mass budget estimates for the Amery Ice Shelf drainage system and the eastern and western parts of the Ross Ice Shelf system of Antarctica are combined with an alternate estimate for the Amery Ice Shelf system, and alternate estimates for the eastern part of the Filchner Ice Shelf system. These systems make up the interior province of Antarctica and their combined net budget is estimated to be positive and in the order of 3 times 10 to the 17th power grams per yr. The Ross Ice Shelf system as a whole is the only system of the interior province for which the estimate of a positive net budget is significant (18 times 10 to the 16th power grams per yr.); direct and indirect evidence con-firms that the western part of the system has a positive net budget. Comparison of the net budget for the interior province with data on sea level change during the last 100 years indicates that the net budget in the peripheral province should be negative. Models of the ice sheet suggest that its response is bi-modal to the present climatic regime. (See also W72-00817) (Knapp-USGS) W72-01176

CLIMATIC CAUSES OF ALPINE GLACIER FLUCTUATION, SOUTHERN VICTORIA LAND.

Kansas Univ., Lawrence. Dept. of Geology.

W. Dort, Jr.

International Symposium on Antarctic Glaciological Exploration (ISAGE), Hanover, N H, September 3-7, 1968; International Association of Scientific Hydrology Publication 86, p 358-362, 1970. 1 fig, 1 ref.

Descriptors: \*Glaciers, \*Regimen, "Glaciation, "Hydrologic budget, Water balance, Climatology, Paleoclimatology, Ablation, Glacial drift, Till, Stratigraphy, Dating. Identifiers: Victoria Land (Antarctica).

Although southern Victoria Land is well known for the present development of oases or ice free valley areas, there is ample evidence that this region has been much more extensively glacierized in the past. Field evidence suggests that fluctuations of the alpine glaciers are caused by local climatic variations mountainous area which, in turn, reflect regional changes. A climatic episode warmer than the present is postulated as the cause of glacier vigor and advance in the recently past history of southern Victoria Land. Recency of the last minor advance of local alpine glaciers is indicated by unstable arrangements of moraine boulders, lack of entrap-ment of wind-blown fines between the blocks, lack of downslope displacement of moraine blocks even in precarious positions on steeply-sloping bedrock surfaces, lack of intense weathering of moraine boulders, and lack of extensive dissection of moraines by localized meltwater streamlets. The last alpine glacier advance in southern Victoria Land probably coincided with the Climatic Op-timum of the Northern Hemisphere and the subsequent cooling that caused glacier starvation coincided with the Northern Hemisphere Neoglaciation. By extension, the climate may now be un-dergoing a warming trend that will result in increased glacier nourishment and activity. (See also W72-00817) (Knapp-USGS)

IS THE ANTARCTIC ICE SHEET GROWING

THICKER, Princeton Univ., N.J. Dept. of Geological and Geophysical Sciences.

International Symposium Glaciological Exploration (ISAGE), Hanover, N H, September 3-7, 1968; International Association Scientific Hydrology Publication 86, p 363-374, 1970. 50 ref. NSF Grant GA-3920.

Descriptors: \*Glaciers, \*Glaciation, \*Antarctic, Hydrology budget, Regimen, Water balance, Climatology, Water levels, Sea levels, Paleoclimatology, Quaternary period, Pleistocene epoch.

Identifiers: Antarctic glaciation.

The Antarctic ice sheet has existed for several million years, it has fluctuated but never disappeared, and the last major retreat of its margin several thousand years ago. The evidence for and against a subsequent growth of the ice sheet center, on a time scale of thousands of years, includes ice and sand-wedges, cavernous weathering, and lichens; possibly advancing glaciers flowing from the ice sheet into the McMurdo Oasis; positive mass budgets for the ice sheet and for individual drainage basins; a possible sea-level fall over the last 4000 yr; the aseismicity of Antarctica; temperature profiles in the ice sheet; strain networks on the ice surface; deep coring studies; ice position surveys; and gravity data. The most likely causes for a growth of the ice sheet would be a post-18,000 BP accumulation increase over Antarctica, or else a build-up in one or more basins towards a mechanical surge. (See also W72-00817) (Knapp-USGS) W72-01178

SNOW ACCUMULATION AND ICE MOVE-MENT ON THE ANVERS ISLAND ICE CAP, ANTARCTICA: A STUDY OF MASS BALANCE, Ohio State Univ., Columbus. Inst. of Polar Studies. A. S. Rundle

International Symposium Glaciological Exploration (ISAGE), Hanover, N H, September 3-7, 1968; International Association of Scientific Hydrology Publication 86, p 377-390, 1970. 7 fig, 6 ref. Grant nos. NSF-GA-165, GA-747, and GA-529.

Descriptors: \*Glaciers, \*Antarctic, \*Hydrologic budget, Water balance, Ablation, Snowfall, Climatology, Paleoclimatology, Data collections, Glaciation, Movement. Identifiers: \*Anvers Island (Antarctica).

The mass balance of a representative part of the Anvers Island ice cap, Antarctica, is approximately in equilibrium. Between November 1965 and January 1968 the average annual accumulation over a 230 sq km area was 380 million metric tons. ring the same period the average annual lo 360 million metric tons. The physical dimensions of the ice cap appear to be stable. The 20 million metric tons, or 5.3 percent, of the recorded accumularic tons, or 3.3 percent, of the recorded accumula-tion, is comparable to the possible errors and as-sumptions in the mass balance equation, and is not regarded as a significant real positive balance. Snow accumulation rates vary considerably from year to year and it is suggested that a longer period of observations would be more suitable for a mass balance evaluation. (See also W72-00817) (Knapp-USGS) W72-01179

SNOW ACCUMULATION ON THE FIMBUL ICE SHELF, WESTERN DRONNING MAUD LAND, ANTARCTICA,

Geological Survey of South Africa, Pretoria. Antarctic Div.

D. C. Neethling.

In: International Symposium on Antarctic Glaciological Exploration (ISAGE), Hanover, NH, September 3-7, 1968; International Association of Scientific Hydrology Publication 86, p 390-404, 1970. 13 fig, 2 tab, 20 ref.

Descriptors: \*Snowfall, \*Antarctic, \*Hydrologic budget, Climatology, Paleoclimatology, Regimen, Glaciers, Glaciation, Ablation, Snowpacks, Sampling, Cores, Climatic data, Meteorological

Identifiers: \*Dronning, Maud Land (Antarctica).

The results of accumulation studies at Dronning Maud Land, and SANAE base, Antarctica, between 1962 and 1966, are summarized with emphasis on temporal variation and spatial dis-tribution of accumulation. The rate of accumulation measured for the period 1963-67 was determined as 43.9 g per sq cm per yr. The annual accumulation varied up to 65% and deviated 38% from the mean. The mean annual accumulation over a period of 17 years shows a consistently higher accumulation rate (in the order of 5-8 cm water) for Norway Station than for SANAE. A marked difference in southerly and westerly surface wind distribution and velocity is evident for these two stations which are only 21 km apart. Southerlies, which are usually associated with low accumulation and high sublimation, have a higher mean velocity and are twice as frequent at SANAE whereas westerlies which may contribute more of the annual accumulation, are six times as frequent at Norway Station. A mean annual accumulation rate of way station. A mean annual accumulation rate of 37.4 g per sq cm per yr for the period 1913 to 1960 has been established by a 32 m pit and SIPRE-core profile at SANAE. Stratigraphic mean annual accumulation values are on the average 11 to 17% higher than stake measurements. (See also W72-00817) (Knapp-USGS) W72-01180

THICKNESS DETERMINATION WILKES,
Bureau of Mineral Resources, Geology and

Geophysics, Melbourne (Australia). G. A. Allen, and R. Whitworth.

International Symposium Glaciological Exploration (ISAGE), Hanover, N H, September 3-7, 1968; International Association of Scientific Hydrology Publication 86, p 405-414, 1970. 6 fig, 12 ref.

Descriptors: \*Glaciers, \*Structural geology, \*Topography, \*Antarctic, Surveys, Seismic studies, Gravity studies, Geophysics, Gravity, Faults (Geology), Geology, Geologic control, Mapping,

Identifiers: Wilkes (Antarctica).

Several surveys outline an ice dome about 100 miles in diameter on the edge of the Antarctic con-tinent at Wilkes. The dome is separated from the continent by a trough in the underlying rock, possibly a major tectonic feature. Over most of the dome, the Bouguer anomaly features are broad and shallow, with an easterly trending high in the north and a low with indistinct trend in the southern area. Rock topography and rock Bouguer anomaly con-tours are parallel. The most prominent feature in the south is the deep trench plunging to 8000 ft below sea level. It trends northwest towards the mouth of the Vanderford Glacier, where a sea bottom depression of similar shape and depth has been observed. The major factor in the development of the ice dome appears to have been the deep trough. It is probably deep enough to cause ice flowing off the main plateau to be channelled around the dome; thus the dome may be an isolated feature, its shape controlled by ice flow dynamics. The rock Bouguer anomaly low and associated peripheral rock ridges in the north suggest a structural low. The linearity and steep slope of the southwestern flank of the dome together with the high Bouguer anomaly gradients indicate a fault downthrown to the southwest. The downthrown block would form the trough of the Vanderford Glacier, suggesting that the total throw could be as high as 6000 ft. (See also W72-00817) (Kapp-USGS) (See also W? W72-01181

THE WILKES ICE CAP PROJECT,
Department of Supply, Melbourne (Australia). An-

tarctic Div.
W. F. Budd.
In: International Symposium on Antarctic Glaciological Exploration (ISAGE), Hanover, N H, September 3-7, 1968; International Association of Scientific Hydrology Publication 86, p 414-429, 1970. 10 fig, 23 ref.

Descriptors: \*Glaciers, \*Glaciation, \*Antarctic, \*Surveys, \*Hydrologic budget, Regimen, Topography, Strain, Temperature, Flow, Gravity studies, Sounding. Identifiers: \*Wilkes Ice Cap (Antarctica).

The Wilkes ice cap, Antarctica, is about 200 km in diameter and rises to 1390 m at its center. Surface velocities and strain rates were measured by repeated tellurometer traverses around a large northern sector and a small southern sector. Seismic and gravity surveys over the region, supplemented in 1967 and 1968 by radio echo soundings, were used to determine the ice thickness, which reaches a maximum of 1300 m. Surface elevations were measured in detail by barometric levelling, supplemented by precise optical levelling. Re-peated gravity readings and optical levelling were carried out to measure directly the change in surface elevation of the ice cap with time. Detailed accumulation measurements over the region are now available for several years and have been used to obtain a net budget of the region. Net budget and flux divergence calculations show the ice cap is not in balance. This lowering rate is in agreement with the direct measurements by repeated gravity surveys. Temperature profiles, flow law parameters, particle paths, and the history of the ice cap are also given. (See also W72-00817) (Knapp-USGS) W72-01182

THE MASS BALANCE OF A COLD GLACIER: MESERVE GLACIER, SOUTH VICTORIA LAND, ANTARCTICA, Ohio State Univ., Columbus. Inst. of Polar Studies. C. Bull, and C. R. Carnein.

In: International Symposium on Antarctic Glaciological Evaluation. (SACE).

Glaciological Exploration (ISAGE), Hanover, N H, September 3-7, 1968; International Association of Scientific Hydrology Publication 86, p 429-446, 1970. 3 fig, 7 tab, 21 ref.

Descriptors: \*Glaciers, \*Antarctic, \*Hydrologic budget, \*Regimen, Snowfall, Melting, Ablation, Evaporation, Runoff, Climates. Identifiers: \*Mass balance, \*Meserve Glacier (An-

The mass balance of Meserve Glacier, on the south side of Wright Valley, Antarctica, is nearly an equilibrium. During the year November 1965, November 1966, the 9.9 sq km glacier lost 60 million kg of ice, equivalent of 0.61 per sq cm over the whole glacier. In that year the snow accumulation was less than usual; in normal years the balance may be slightly positive. On the 1.8 sq km ablation tongue of the glacier the annual loss ranges up to about 34 g per sq cm, near the snout at 440 m elevation. Of this amount, 40% occurs during the cold months from mid-February to mid-November. During the summer, a small amount of melting oc-curs on the 15 m-high cliffs around the glacier tongue, and around the margins of the glacier's upper surface, but only 2 or 3% of the total loss is by meltwater runoff. Dry calving from the cliffs amounts to about 1.5% of the total mass loss from the glacier. Evaporation from a melting surface may account for 40% of the total loss. The remaining loss is by sublimation. (See also W72-00817) (Knapp-LISCIST W72-01183

RECENT GLACIER RETREAT ON HEARD

ISLAND, Sydney Univ. (Australia). School of Public Health

and Tropical Medicine.
G. M. Budd, and P. J. Stephenson.

o. m. nuoq, and P. J. Stephenson. In: International Symposium on Antarctic Glaciological Exploration, N H, September 3-7, 1968; International Association of Scientific Hydrology Publication 86, p 449-458, 1970, 4 fig, 5 plate, 25 ref.

Descriptors: \*Glaciers, \*Glaciation, \*Climates, \*Weather, \*Regimen, Surveys, Meteorological data, Melting, Ablation, Hydrologic budget, Temperature, Indian Ocean. Identifiers: \*Heard Island (Indian Ocean).

A survey of glaciers on Heard Island (southern Indian Ocean) in 1963 showed that general major retreat had recently occurred. Re-survey in 1965 suggested possible readvance in two glaciers. Photographic and other records from expeditions visiting the island in 1874, 1902 and 1929, and 1927, 1965, shown a consequent changes used 1947. 1947-1955, show no apparent changes until 1947 but general minor recession by 1955. Meteorologi-cal records show a rise in air temperature since 1948, which seems to be the major cause of the retreat. Possible movement of the Antarctic Convergence cannot be demonstrated and volcanic activity is discounted as a general influence. (See also W72-00817) (Knapp-USGS) W72-01184

CHEMICAL AND PHYSICAL CHARAC-OF MESERVE GLACIER TERISTICS OF MESERVE GLACIER MORAINAL SOILS, WRIGHT VALLEY, AN-TARCTICA: AN INDEX OF RELATIVE AGE, Ohio State Univ., Columbus, Inst. of Polar Studies. K. R. Everett, and R. E. Behling.

In: International Symposium on Antarctic Glaciological Exploration (ISAGE), Hanover, N H, September 3-7, 1968; International Association of Scientific Hydrology Publication 86, p 459-460,

Descriptors: \*Glaciation, \*Antarctic, \*Glacial drift, \*Weathering, \*Dating, Soil formation, Stratigraphy, Geomorphology, Soil chemical properties. Identifiers: \*Meserve Glacier (Antarctica).

An extensive program of soil sampling and weathering index studies was carried out on the moraine complex of the small, alpine, Meserve Glacier, Antarctica, to determine if age differences among the three major moraines would become apamong the three major morannes would become ap-parent in the morphology, chemistry, or clay mineralogy of their soil profiles, permafrost depths or surface weathering characteristics. Based upon morphologic and pedologic evidence, the outer-most of the three groups of moraines appears much older than either of the other two. This moraine has it part been busied by one or both of the volumer. in part been buried by one or both of the younger moraines. (See also W72-00817) (Knapp-USGS)

W72-01185

GLACIO-GEOLOGICAL SURVEY ON THE KRONPRINS OLAV KYST, ANTARCTICA (EX-TENDED ABSTRACT),

Hiroshima Univ. (Japan). Dept. of Geography. Y. Yoshida.

International Symposium Glaciological Exploration (ISAGE), Hanover, N H, September 3-7, 1968; International Association of Scientific Hydrology Publication 86, p 461-463, 1970 16

Descriptors: \*Geomorphology, \*Antarctic, Glaciation, Glacial drift, Beaches, Erosion, Weathering, Surveys, Sediments, Sedimentation, Topography.

Geomorphological surveys on ice-free areas near Syowa Base in 1967-68 were carried out by the 8th Syowa Base in 1967-68 were carried out by the 8th Japanese Antarctic Research Expedition with helicopter flights in the summer seasons and snow-car traverses in winter. Attention was paid mainly to raised beaches, but glaciated landforms were also observed. Biological and geochemical surveys were often made in cooperation with the geomorphological survey. Erosional features such as striations, quarried surfaces and glacial troughs attain to high development on almost all areas, but depositional features are poorly seen. This implies that stagnation of the ice margin did not occur on that stagnation of the ice margin did not occur on present ice-free areas during the receding stage of the ice sheet. The formation of sorted polygons on recessional moraines probably dates back to a period with less snow accumulation. Numerous well-preserved raised beaches were found in 1967-68. The highest beach in Lutzow-Holmbukta is about 20 m above sea level, and in Shinnan iwa, about 30 m. Five to seven levels can be seen in highly developed beaches. Pitted beaches are scarce in the region, which may be the result of the rapid retreat of inland ice margin. (See also W72-00817) (Knapp-USGS) W72-01186

MOVEMENT DETERMINATION OF THE ROSS ICE SHELF, ANTARCTICA, New Brunswick Univ., Fredericton. Dept. of Sur-

veying Engineering.

E. Dorrer. In: International Symposium Glaciological Exploration (ISAGE), Hanover, N H, September 3-7, 1968; International Association of Scientific Hydrology Publication 86, p 467-471, 1970, 2 fig, 1 tab, 4 ref.

Descriptors: \*Surveys, \*Glaciers, \*Measurement, \*Movement, Mapping, Calibrations, Ice, Glaciation, Sea ice.
Identifiers: \*Ice movement surveys.

Horizontal movements of very large ice sheets and ice shelves can be determined by astronomical positioning, by satellite triangulation, aerial photo-grammetric triangulation, or geodetic traversing. Because of their dependency upon time, all originally incoherent measuring quantities must be reduced to a reference time. Two reduction methods are available for traverses measured at least twice: (1) both sets of observations are reduced directly to two corresponding reference times. The movement can be measured by compar-ing the results of the two fixed and independent traverses. (2) the positions of the traverse points, taken at the time of actual measurement, are adjusted to slightly different positions along a predetermined approximation of their flow line, according to the slightly different times of observation of the adjacent traverse quantities. Both ends of a traverse or triangulation chain should be tied to fixed points on land. Astronomical control azimuths should be measured at points along the traverse including the fixed points at both ends. If more information is desired on horizontal deformation, either the traverse should follow a distinct zig-zag course or a triangulation or trilateration chain should be utilized. (See also W72-00817) (Knapp-USGS) W72-01187

#### Group 2C—Snow, Ice, and Frost

ICE MOVEMENT IN THE MCMURDO SOUND AREA OF ANTARCTICA, Scott Polar Research Inst., Cambridge (England).

C. Swithinbank.

In: International Symposium on Antarctic Glaciological Exploration (ISAGE), Hanover, N H, September 3-7, 1968; International Association of Scientific Hydrology Publication 86, p 472-487, 1970. 4 fig, 1 tab, 33 ref.

Descriptors: \*Glaciers, \*Movement, \*Sea ice, \*Antarctic, \*Ablation, Regimen, Sounding, Bottom sediments, Sea water, Freezing, Melting,

Icebergs.
Identifiers: \*Ross Ice Shelf (Antarctica), \*McMurdo Sound (Antarctica).

Movement of the Ross Ice Shelf was observed at seven points in the accumulation area and sixteen points in the ablation area. Rates of movement varied from 690 m per year off Cape Crozier to 2 m per yr off Black Island. An airborne radio echo sounder was used to attempt ice depth measurement at all points. Depths were determined without difficulty in accumulation areas but only intermittently in ablation areas. Sponges, shells, corals, and pebbles were found on the ice surface 50 km from the ice front. Their distribution is consistent with the hypothesis that sea floor material is raised to the bottom of the ice shelf by anchor ice and finally to the top surface by ablation and bottom freezing. There appears to be a history of extensive ice front followed by the growth in situ of new ice shelf. There may have been lakes of open water up to 45 km inland from the ice front. (See also W72-00817) (Knapp-USGS). W72-01188

## THE STRUCTURE OF THE FILCHNER ICE SHELF AND ITS RELATION TO BOTTOM MELTING,

Geological Survey, Denver, Colo.

J. C. Behrendt.

International Symposium on Antarctic Glaciological Exploration (ISAGE), Hanover, N. H., September 3-7, 1968; International Association of Scientific Hydrology Publication 86, p 488-496, 1970. 5 fig, 13 ref.

Descriptors: \*Ice, \*Glaciers, \*Sea ice, \*Antarctic, \*Movement, Regimen, Ablation, Mapping, Snowpacks, Melting, Topography, Temperature. Identifiers: \*Filchner Ice Shelf (Antarctica), \*Edith Ronne Ice Shelf (Antarctica).

Measurements of snow thickness, elevation, ice thickness and bedrock topography made during 1956-66 were used in the compilation of revised maps of these parameters for the area of Antarctica south of the Weddell Sea. The total ice shelf area shown on these maps is 0.48 million sq km. If the drainage system is in balance, an average movement rate for the combined ice fronts of 1.9 plus or minus .6 km/yr is required assuming no melting. This high rate suggests a significant amount of bottom melting may take place, considering that the movement of the Filchner ice shelf front is 1.5 km yr. The profiles of ice thickness vs. distance along assumed flow lines are greatly different for the Filchner and the Edith Ronne ice shelves. The Filchner ice shelf thins 300 m in the 100 km nearest the ice front; solutions of the strain equation indicate a high melt rate from the ice front back 50-100 km. The Edith Ronne ice shelf has its maximum thinning south of Berkner Island, near the junction with the Filchner ice shelf and it thins only 300 m in the 300 km in from the ice front. (See also W72-00817) (Knapp-USGS) W72-01189

#### STRAIN NETWORKS ON THE MCMURDO ICE

Department of Scientific and Industrial Research. Wellington (New Zealand). Antarctic Div. A. J. Heine.

International Symposium Glaciological Exploration (ISAGE), Hanover, N H, September 3-7, 1968; International Association of Scientific Hydrology Publication 86, p 497-507, 1970. 5 fig, 3 tab, 7 ref.

Descriptors: \*Glaciers, \*Ice, \*Antarctic, \*Surveys, \*Strain, Movement, Measurement, Mapping.

The McMurdo Ice Shelf consists of ice moving from the Ross Ice Shelf in the east, as well as that moving from two glaciers from Ross Island in the north. To study the movement of this ice, a 10 km grid consisting of 1 km strain triangles was laid out across the Ice Shelf during the 1964-65 summer. Additional strain lines were set out at certain selected stations in line with the calculated direction of the principal axes. It was found that an equilateral triangle with side length of 500 m is adequate for strain measurements. The configuration is essentially a triangle with three lines joining the apices of the center point of the triangle. The results of the strain measurements show a positive vertical strain rate or a thickening of the ice shelf. (See also W72-00817) (Knapp-USGS)

#### SEA ICE: ANTARCTIC ASPECTS,

Melbourne Univ. (Australia). Dept. of Meteorolo-

P. Schwerdtfeger.

International Symposium on Antarctic Glaciological Exploration (ISAGE), Hanover, N H, September 3-7, 1968; International Association of Scientific Hydrology Publication 86, p 511-520, 1970. 4 fig, 2 tab, 15 ref.

Descriptors: \*Sea ice, \*Antarctic, \*Snyoptic analysis, Climatology, Freezing, Melting, Hydrologic budget, Reviews, Surveys, Analog models, Albedo, Heat budget, Temperature, Ocean currents, Air circulation. Identifiers: Atmospheric circulation.

Theoretical and laboratory investigations of sea ice in the Antarctic are reviewed. Because of the complex thermal and mechanical perturbations suffered by sea ice under such oceanic conditions, analog computations are suggested as being promising. In the light of basic heat economy determinations, it is suggested that the effect of a varia-ble and extensive Antarctic sea ice cover on global atmospheric circulation patterns warrants intensive study. (See also W72-00817) (Knapp-USGS) W72-01191

#### THE THERMAL BALANCE OF SEA ICE AT HALLEY BAY, British Meteorological Office, Bracknell (En-

gland). D. W. S. Limbert.

International Symposium on Antarctic Glaciological Exploration (ISAGE), Hanover, N H, September 3-7, 1968; International Association of Scientific Hydrology Publication 86, p 520-541, 1970. 6 fig, 7 tab, 15 ref.

Descriptors: \*Sea ice. \*Antarctic. \*Heat balance. \*Heat transfer, Albedo, Freezing, Advection, Convection, Regimen, Temperature, Meteorology, Heat budget, Turbulence, Heat flow. Identifiers: \*Halley Bay (Antarctica).

A limited study of the thermal balance of sea ice was attempted at Halley Bay, Antarctica, in 1959, using monthly mean temperatures to deduce changes in heat storage, heat fluxes, and the conductivity of the ice. Growth rates of sea ice with and without snow cover provide further conductivity estimates. The air temperatures over the sea ice were mostly one or two degrees higher than simultaneous temperatures over the ice shelf 3 km away, and in the lowers layer lapse conditions existed in winter, in contrast to the inversions prevailing over the ice shelf. It is concluded that turbulent transfer of heat was a major factor in the growth of the sea ice. (See also W72-00817) (Knapp-USGS) W72-01192

### GEODETIC RESULTS OF THE ROSS ICE SHELF SURVEY EXPEDITIONS, 1962-63, AND

1965-66, Technische Universitaet, Brunswick (West Germany). Dept. of Photogrammetry and Cartog-

raphy. E. Dorrer, W. Hofmann, and W. Seufert. Journal of Glaciology, Vol 8, No 52, p 67-85, February 1969. 13 fig, 16 ref.

Descriptors: \*Ice, \*Antarctic, \*Surveys, \*Movement, \*Mapping, Glaciers, Instrumentation, Data processing, Data collections, Measurement. Identifiers: \*Ross Ice Shelf (Antarctica).

By means of modern geodetic observation techniques the ice movement along an east-west and a north-south profile across the Ross Ice Shelf, Antarctica, was measured during the two Antarctic summers, 1962-63 and 1965-44. placed on the 910 km long traverse. Distances were measured by tellurometer, and traverse angles by a precision theodolite between all consecutive markers, normally 8 to 9 km apart. For this type of observation method, six men distributed into three groups of two men each were necessary. As the ice moves, the geometrical configuration of the traverse changes during the epoch of observation. For this 'reduction to epoch' problem two methods are described in detail: (1) time reduction of observations, and (2) time reduction of positions. Between the two field journeys, only linear ice movement can be assumed. It is possible, however, to determine acceleration and curvature of the ice flow at all traverse points where the traverse ang differ considerably from 180 deg. The result of all computations is the field of velocity vectors along the traverse. Obvious characteristics are the rapid increase of velocity between the McMurdo Ice Shelf and Ross Ice Shelf, the uniform and nearly parallel movement in the middle of the ice shelf (maximum velocity 935 meters/year), the decrease of velocity along the north-south profile, and the systematic increase of divergence of the flow lines towards the ice margins. Careful study of the velocity vector field shows some deviations from an entirely uniform distribution. (Knapp-USGS) W72-01381

#### ERRORS IN SHORT-TERM ABLATION MEA-SUREMENTS ON MELTING ICE SURFACES,

McGill Univ., Montreal (Quebec). Faculty of Graduate Studies and Research. F. Muller, and C. M. Keeler. Journal of Glaciology, Vol 8, No 52, p 91-105, February 1969. 9 fig, 3 tab, 23 ref.

Descriptors: \*Glaciers, \*Ablation, \*Water balance, Pescriptors: "Glaciers, "Aplation," water balance, "Instrumentation, Core drilling, Sampling, Discharge (Water), Weathering, Surveys, Meteorology, Hydrologic budget, Weather, Heat balance, Topography, Temperature. Identifiers: Ablation instruments.

Rapid changes in time and space in the micro-relief of an ablating glacier surface and radiation-induced melt within the uppermost ice layer, termed the 'weathering crust' seriously affect the accuracy of the short-term ablation measurements. The various measuring techniques commonly used (stakes, ablatometers, ablatographs) and some new methods (measurement of discharge from a small supraglacial drainage basin, and mass loss directly measured on core samples) are critically reviewed and assessed in the light of these phenomena. The implications for studies of heat and mass balance are discussed. The direct measurement of mass flux is the most accurate means of assessing short-term ablation rates. The errors in short-term ablation measurements by any method are largely com-pensatory and consequently do not influence longeriod mass-balance estimates. (Knapp-USGS) W72-01382

#### PRIMARY TRANSVERSE CREVASSES,

Ohio State Univ., Columbus. Inst. of Polar Studies. G. Holdsworth.

Journal of Glaciology, Vol 8, No 52, p 107-129, February 1969. 12 fig. 4 tab, 30 ref, 3 append. NSF Grants GA-205 and GA-532.

Descriptors: \*Glaciers, \*Strain, \*Movement, \*Fractures (Geology), \*Rheology, Stress, Deformation, Plastic deformation, Elastic theory, Antarctic, Regimen. Identifiers: \*Crevasses, \*Strain rate, Canada.

Measurements of strain-rates on a temperature glacier in a region of initial transverse fracturing incier in a region of initial transverse fracturing indicate a critical strain-rate of 0.000035/day, associated with a regional strain-rate gradient of 0.00000005/day/meter. At only one section of the glacier is the theoretical longitudinal strain-rate in approximate agreement with the value measured at the surface at that point. Corresponding measurements on a polar glacier (temperature -27.9 deg C at 10 m depth during the summer) indicate that the critical strain-rate and gradient are about 1/10. critical strain-rate and gradient are about 1/10 those of temperate glaciers. At one section there is close agreement between the theoretical and mea-sured longitudinal strain-rate. For the temperature glacier crevasse depths ranged from 23.5 to 28 m; in the polar glacier one crevasse was 29,9 - 0.5 m deep, assuming a wedge form. Over a distance of 1.2 km the temperate glacier transverse crevasse spacings are very variable. In the cold ice, crevasse spacings are far more uniform, ranging from 57 m to 66 m. This greater uniformity of spacing may be explained in terms of the dynamics of flow. Despite large differences in thermal, dimensional and in-rate parameters between the two glaciers (1) the crevasse depths are closely similar, and (2) the spacings of crevasses are similar. The assumption of negligible strain on an intercrevasse block is not correct. The direction of the principal extending strain-rate is perpendicular to the crevasse traces. (Knapp-USGS)
W72-01383

#### EFFECT OF TEMPERATURE ON THE CREEP OF ICE.

OF ICE, Army Terrestrial Sciences Center, Hanover, N. H. M. Mellor, and R. Testa. Journal of Glaciology, Vol 8, No 52, p 131-145, February 1969. 11 fig. 6 tab, 17 ref.

Descriptors: \*Rheology, \*Creep, \*Ice, \*Deformation, \*Cryology, Temperature, Pressure, Plastic deformation, Plasticity, Stress, Strain, Movement, Glaciers, Crystallography, Strength of materials. Identifiers: \*Strain rate.

Creep tests on homogeneous, isotropic polycrystal-line ice gave an apparent activation energy for creep of 16.4 kcal/mol over the temperature range -10 deg to -60 deg C. Above-10 deg C the Arrhenius relation for temperature dependence is invalid, and creep rate becomes progressively more temperature dependent as the melting point is approached. Between -20 deg and -50 deg C the apparent activation energy for creep of a single crystal of ice was found to be 16.5 kcal/mol. A complete creep curve for a single crystal loaded in uniaxial compression parallel to the basal plane was qualitatively similar to the classical creep curve; creep rate at all stages was very much faster than for polycrystalline ice under the same conditions. Creep tests on polycrystalline ice at 0 deg C gave a stress/strain-rate relation for that temperature, but its precise meaning is nuclear, since recrystalliza-tion complicated the results. (Knapp-USGS) W72-01384

# ICE-FABRIC STUDY OF THE MAWSON RE-GION, EAST ANTARCTICA, Department of External Affairs, Melbourne (Aus-

tralia). Antarctic Div. K. Kizaki.

Journal of Glaciology, Vol 8, No 53, p 253-276, June 1969. 13 fig, 5 tab, 20 ref, append.

Descriptors: \*Ice, \*Glaciers, \*Strain, \*Crystallography, \*Crystal growth, Cryology, Petrofabrics, Rheology, Temperature, Regimen, Particle size. Identifiers: \*Ice fabrics, Strain rate.

Attempts were made to test the relation between strain-rates and the ice-fabric patterns obtained at Mawson station, east Antarctica. These orientation fabrics not only are poorly related to predicted values but also change easily within a strain grid with 100 m diagonals. Stable patterns of two- and three-maximum fabrics are confirmed. The 3-maximum pattern is common and stable in the coarse ice at the surface of the ice sheet. It is apparent that the fabric patterns are generally related to grain-size. The single-maximum fabric always occurs in fine-grained ice, and more maxima are formed in the course of grain growth. It appears that syntec-tonic-secondary recrystallization is effective in producing the orientation fabrics with two, three and multiple maxima. Also, the maxima always shift away from the pole of foliation as grain-size increases and there are several stable positions of maximum such as 0 deg, 17 deg, 23 deg, and 30 deg. It is expected that further stable angles would occur with coarser crystals as found in temperate glaciers. (Knapp-USGS) W72-01385

# THE HEAT AND MASS BALANCE OF SNOW DUNES ON THE CENTRAL ANTARCTIC PLATEAU, Melbourne Univ. (Australia). Dept. of Meteorolo-

Journal of Glaciology, Vol 8, No 53, p 277-284, June 1969. 7 fig, 8 ref.

Descriptors: \*Snow, \*Antarctic, \*Heat balance, \*Water balance, Dunes, Snowpacks, Snow cover, Solar radiation, Heat budget, Meteorology. Identifiers: Snow dunes, Mass balance.

The heat-balance components of the faces of snow blocks were measured at Plateau station on the Antarctic plateau using micro-meteorological instru-mentation. Heat-balance considerations and sublimation observations indicate considerable mass loss from the sloping snow surfaces during summer but little loss from horizontal surfaces. This process tends to level the irregularities of the snow surface. This process is applicable to the snow dunes forming the general accumulation pattern on the Antarctic plateau. (Knapp-USGS)
W72-01386

# ON THE USE OF ASYMPTOTIC SOLUTIONS TO PLANE ICE-WATER PROBLEMS, Alberta Univ., Edmonton. Dept. of Mechanical En-

gineering. G. S. H. Lock.

Journal of Glaciology, Vol 8, No 53, p 285-300, June 1969. 9 fig, 13 ref.

Descriptors: \*Glaciers, \*Ice, \*Cryology, \*Heat transfer, \*Melting, Freezing, Thermodynamics, Convection, Radiation, Heat flow, Mathematical studies, Density, Sea ice. Identifiers: Ice-water systems.

One-dimensional freezing and thawing of ice-water systems are analyzed for the conditions first ex-amined by Stefan. An order-of-magnitude analysis applied to the governing equations and boundary conditions quantifies the error resulting from the neglect of various factors, principal among which are density difference, initial superheat and variable properties. Asymptotic solutions for the temperature distribution and interface history are developed for a wide range of boundary conditions, including prescribed temperature or heat flux, prescribed convection, and prescribed radiation. Comparison with measurements reveals the general adequacy of the asymptotic solutions and an estimate of the conditions of the conditions and the conditions are conditional to the conditions and the conditions are conditionally conditions. mate of the error incurred. (Knapp-USGS) W72-01387

### THE U S A CRREL DRILL FOR THERMAL CORING IN ICE,

For primary bibliographic entry see Field 07B. W72-01388

STEADY-STATE TEMPERATURES AT THE BOTTOM OF ICE SHEETS AND COMPUTATION OF THE BOTTOM ICE FLOW LAW FROM THE SURFACE PROFILE, Centre National de la Recherche Scientifique,

Grenoble (France). Laboratoire de Glaciologie.

L. Lliboutry.

Journal of Glaciology, Vol 7, No 51, p 363-376,
October 1968. 4 fig, 2 tab, 14 ref, append.

Descriptors: \*Glaciers, \*Movement, \*Rheology, \*Heat flow, \*Temperature, Melting, Pressure, Deformation, Strain, Stress, Topography, Regimen, Profiles, Equations. Identifiers: Flow laws (Glaciers).

A solution for the steady flow of a cold ice sheet takes account of the heat released by deformation. Because this strain heating increases the strain velocity, the bottom temperature may be unstable. A set of five equations with five unknowns allows the surface profile and the bottom temperature to be computed step by step by an iterative process. This was done by computer for three very different models of ice sheets, each case with three different values of the constant B in Glen's ice flow law. In values of the constant of the first leady-state temperature profiles could not be computed beyond a moderate distance from the ice divide. The correct value of B for bottom ice may be deduced from the actual surface profile. At the bottom of Greenland ice sheet, B is about 2.18. This is about thirteen times bigger than for most alpine glaciers. (Knapp-USGS) W72-01389

#### FLOW TILLS AND RELATED DEPOSITS ON SOME VESTSPITSBERGEN GLACIERS,

Birmingham Univ. (England). Dept. of Geology. G. S. Boulton. Journal of Glaciology, Vol 7, No 51, p 391-412, October 1968, 14 fig, 19 ref.

Descriptors: \*Glaciation, \*Sedimentation, \*Till. \*Glacial soils, \*Glacial drift, Clays, Stratigraphy, Sediments, Deposition (Sediments), Provenance, Sediment transport, Glaciers, Movement. Identifiers: \*Flow till.

In three outlet glaciers of the highland ice of Ny Friesland, debris derived from the glacier bed oc-curs in thick bands which dip steeply up-glacier. As the glacier wastes down, this debris is released on the surface to form thick supraglacial tills, which may remain on the glacier surface or flow down it onto bedded deposits which fringe the glacier in the proglacial zone. A frequent result of this process is the production of multi-till sequences which result from a single glacier retreat phase, rather than from multiple advance and retreat. The sedimentological features and fabrics of englacial debris bands and reatures and rapics of englacial debris bands and flow tills are described, and a mechanism for the formation of 'controlled' and 'uncontrolled' humocky moraine is suggested. Many flow tills are identical to the compact fine-grained tills common in lowland glacial deposits of Pleistocene age in Europe and North America, and it is suggested that some of the latter could be flow tills. (Knapp-USGS) W72-01390

# A SUPRAGLACIAL EXTENSION OF AN ICE-DAMMED LAKE, TUNSBERGDALSBREEN, Glasgow Univ. (Scotland). Dept. of Geography.

Journal of Glaciology, Vol 7, No 51, p 413-419, October 1968. 1 fig, 11 ref.

Descriptors: \*Glaciers, \*Lakes, \*Floods, Discharge (Water), Water levels, Regimen, Melting, Ablation. Movement, Ice. Identifiers: \*Norway, \*Glacial lakes.

Observations on Tunsbergdalsbreen show that an ice-dammed lake, Store Brimkjelen, overflowed on to the surface of the glacier. The lake lifted a section of the glacier and formed a long irregular crevasse along the line of dislocation. Movement of a glacier over an irregular surface can open small

#### Group 2C—Snow, Ice, and Frost

cavities under the ice sufficient to allow water to penetrate and start the drainage from the lake. Once the water begins to flow, the tunnel under the ice will be widened by melting as a result of a heat surplus if the temperature of the water is above freezing. From the observations at Tunsbergdalsbreen, it is evident that both flotation of the ice and the formation of a subglacial tunnel have occurred, and drainage from the ice-dammed lake may be produced by a combination of these two processes. When the critical level was reached in the central parts of the ice cliff, uplift of the ice bar-rier would allow subglacial penetration of the water. The pressures than exerted by the water beneath the ice could have initiated drainage through the former subglacial stream course in the bottom of the valley. (Knapp-USGS) bottom of the W72-01391

FABRIC ANALYSIS OF A CORE FROM THE MEIGHEN ICE CAP, NORTHWEST TERRITO-RIES, CANADA.

Ohio State Univ., Columbus. Inst. of Polar Studies. R. M. Koerner.

Journal of Glaciology, Vol 7, No 51, p 421-430, October 1968. 5 fig, 1 tab, 13 ref.

\*Cores, \*Sampling, Descriptors: \*Glaciers, \*Petrofabrics, Ice, Core drilling, Crystallography, Particle size, Particle shape, Crystallizatiori Cryology, Glaciation. Identifiers: \*Meighen Ice Cap (Canada), \*Ice

Ice samples from a 121 m core, representing the total thickness of the Meighen Ice Cap near its highest point, were studied for ice fabric, firn- and dirt-layer distribution. The absence of a strongly preferred fabric between the surface and the base of the ice can at the core site suggests an absence of past or present ice movement at this point. From the variations of ice texture, firn- and dirt-layer distribution with depth it is concluded that the ice cap post-dates the climatic optimum and has hever been much thicker than it is at present. There is a possible relic ablation surface at a depth of 50 m which is estimated to be at least 500-600 years old.

THE MIDSUMMER HEAT BALANCE OF AN ALASKAN MARITIME GLACIER

(Knapp-USGS) W72-01392

Alaska Univ., College. Geophysical Inst. N. A. Streten, and G. Wendler. Journal of Glaciology, Vol 7, No 51, p 431-440, October 1968. 7 fig, 4 tab, 14 ref.

Descriptors: \*Glaciers, \*Regimen, \*Heat balance, \*Alaska, Water balance, Solar radiation, Heat flow, Humidity, Advection, Convection, Albedo, Data collections, Ablation, Melting. Identifiers: \*Worthington Glacier (Alaska).

The heat balance of an Alaskan mountain glacier located close to the sea was calculated for a period of 16 days in midsummer -- a period which is typical of the summer in this region in its high cloudiness and in its temperature and humidity conditions. The radiative and the combined sensible and latent heat components contribute equally to the ob-served high rate of ice melting. During the whole period 1.12 m of ice melted requiring 8,140 cal per sq cm. The components of the balance are tabu-lated both as totals and on a daily basis. Comparison of a series of photographs taken at the glacier between 1937 and the present indicate a considerable retreat of the ice. (Knapp-USGS) W72-01393

AVALANCHE ACTIVITY ON THE VAUGHAN LEWIS ICEFALL, ALASKA,

Case Western Reserve Univ., Cleveland, Ohio.
A. C. Pinchak.

Journal of Glaciology, Vol 7, No 51, p 441-448, October 1968. 3 fig, 1 tab, 3 ref, 2 append.

Descriptors: \*Avalanches, \*Glaciers, \*Alaska, Ice statistical methods, Correlation analysis, Move-ment, Frequency analysis, Temperature, Regimen. Identifiers: \*Vaughan Lewis Icefall (Alaska).

Avalanche data were obtained by direct observa-tion of the Vaughn Lewis Icefall, Alaska. Magnitude, time and location of each ice fall were nitude, time and location of each ice fall were recorded and the resulting data were analyzed statistically. An inverse relationship was found between the relative frequency and the magitude of the avalanches. A significant diurnal variation in avalanche rate was also detected. During the early morning hours the avalanche rate reached a max morning hours the avalanche rate reached a maximum. No secondary increase in the avalanche frequency was observed during the evening cooling period. A given ice fall results in an increased probability of an ice fall occurring shortly thereafter. After approximately 4 min the effect of a given avalanche no longer correlates with succeeding avalanches. (Knapp-USGS) W72-01394

COASTAL GEOMORPHOLOGY, MCMURDO SOUND, ANTARCTICA, Tufts Univ., Medford, Mass. Dept. of Geology.

R. L. Nichols.

Journal of Glaciology, Vol 7, No 51, p 449-478, October 1968. 24 fig, 1 tab, 27 ref.

Descriptors: \*Gemorphology, \*Beaches, \*Antarctic, \*Deltas, \*Glacial drift, Glaciers, Glaciation, Erosion, Sedimentation, Sediment transport, Deposition (Sediments), Sea ice, Snowpacks, Beach erosion, Surf, Till, Loess. Identifiers: \*McMurdo Sound (Antarctica).

Well-developed elevated beaches, deltaic deposits, marine-boulder pavements and wave-washed bedrock surfaces are found in the McMurdo Sound area of Antarctica from Cape Bernacchi north to Granite Harbor. The highest measured marine feature, an elevated beach at Dunlop Island, is 20 m above sea level. The highest beaches at Marble above sea level. The nignest beaches at Marbie Point and Cape Roberts, about 48 km apart, are about 20 m above sea level. The marine limit between these two points is, therefore, essentially horizontal. The highest beach at Cape Bernacchi, approximately 4.8 km south of Marble Point, is about 12 m above sea level. Well-developed elevated beaches disappear about 3.2 km south of Cape Bernacchi and are not found between this Cape Bernacent and are not found between this point and Koettlitz Glacier. These beaches post-date the youngest glaciation recognized in the lower Wright Valley. A C-14 analysis of an elephant seal buried in a 13 m beach at Marble Point indicates that this beach is 4,450 plus or minus 150 years old. As sea level at this time was approximately 3 m lower than at present, the Marble Point area has risen isostatically about 16 m during the last 4,450 plus or minus 150 years. Pitted beaches, beaches deposited on ice, a buried elephant seal and gravel ridges deposited by ice in-dicate that all of the beaches were formed in a climate like that now found in the area. (Knapp-USGS) W72-01395

SLIP IN SINGLE CRYSTALS OF ICE. Imperial Coll. of Science and Technology, London (England). Dept. of Cloud Physics.

C. J. Readings, and J. T. Bartlett.

Journal of Glaciology, Vol 7, No 51, p 479-491,
October 1968. 9 fig, 22 ref.

Descriptors: \*Deformation, \*Ice, \*Shear, \*Strain, Shear stress, Shear strength, Strength of materials, Crystallography, Creep, Mechanical properties, Plastic deformation, Glaciers, Movement, Rheology, Cryology. Identifiers: \*Ice deformation.

Rectangular specimens of ice (5 cmX2 cmX0.5 cm) were cut from large single crystals (10 cm X5 sq cm) grown from pure water by a modified Bridgman technique. When these specimens were deformed under controlled conditions, slip lines which were predominantly parallel to the basal plane became visible. In some cases short, perpendicular segments were also seen which can be interpreted as evidence for cross-slip in ice. Measure ments of slip-band spacings were made on silvered 'formvar' replicas of some deformed crystals. rements showed that 'coarse' s curred when the resolved shear stress on the basal plane was greater than about 0.2 bars, and that the average thickness of the slip lamellae, was approxi-mately given by Wakahama's relationship. At lower stresses 'fine' slip occurred, and the relationship between the average thickness of the lamellae and the resolved shear stress was more adequately described by Taylor's formula. It is, however, possi ble that both coarse and fine slip occurred at higher stresses, but that the fine slip was then below the limit of resolution. (Knapp-USGS) W72-01396

BUOYANCE-STABILIZED HOT-POINT DRILL FOR GLACIER STUDIES, Cold Regions Research and Engineering Lab., Hanover, N. H. H. W. C. Aamot.

Journal of Glaciology, Vol 7, No 51, p 493-498, October 1968. 3 fig, 4 ref.

Descriptors: \*Drilling, \*Drilling equipment, \*Ice, \*Glaciers, \*Melting, Sampling, Observation wells, Equipment, Instrumentation. Identifiers: \*Ice drills, \*Thermal drills.

Hot-point drills are practical for producing holes in glaciers for ice-thickness and temperature mea-surements, as well as other glaciological studies. Buoyancy stabilization assures a vertical attitude of the drill and a plumb hole. This is achieved by designing a drill with a heavy hot point and a light upper section which is buoyant in the surrounding melt water. The buoyant force is less than the weight of the drill in air but its rectifying moment about the fulcrum (the tip) is greater than the tilt-ing moment of the drill weight. Two methods to prevent refreezing of the melt water are proposed in order to permit drilling in cold ice and to assure continued access to the hole. (Knapp-USGS) W72-01397

PRESENT-DAY GLACIERS IN THE U. S.S.R. AND SOME DATA ON THEIR MASS BALANCE, Akademiya Nauk SSSR, Moscow. Institut Geografii.

M. G. Grosval'd, and V. M. Kotlyakov. Journal of Glaciology, Vol 8, No 52, p 9-22, February 1969. 2 fig, 6 tab, 38 ref.

Descriptors: \*Glaciers, \*Regimen, \*Surveys, Water balance, Movement, Data collections, Hydrologic data, Time series analysis, Climatology, Solar radiation.

Identifiers: \*Mass balance (Glaciers), Climatic

Major glaciers are located in the Atlantic-Arctic, Atlantic-Eurasian, East Siberian, and Pacific-Asian regions of the USSR. The total area of the glaciers in the USSR amounts to 81,900 sq km, and the volume of water stored in them to 13,750 cu km. The main characteristic features of glacier regime, such as the elevation of the equilibrium line, the value of the total accumulation at the equilibrium line, the vertical gradients of net balance, the 'glacier ratios', etc., are estimated for the majority of the glaciers. The data on mass balance of the glaciers in the Polar Urals and Tien Shan which were obtained by direct measurement during the last decade are tabulated and compared. The glacier balance changes in the two areas are nonsynchronous. A comparison of the variations in mass balance of the Lednik IGAN in the Polar Urals and the Grosser Aletschgletscher in the Swiss Alps suggests a cyclic trend of the variations in both regions with a wave-length of about 22 years, and direct opposition in their phases. The ar of 22-year cycles of the balance variations with the cyclic fluctuations of the same wave-length in solar

activity seems to be quite evident, and the atmospheric circulation appears to be one of the main intermediate variables in the chain responsi-ble for the out-of-phase relationship in glacier variations. (Knapp-USGS) W72-01398

# GLACIAL FEATURES OF TANQUARY FIORD AND ADJOINING AREAS OF NORTHERN EL-LESMERE ISLAND, N.W.T., Defense Research Telecommunications Establish-

ment, Ottawa (Ontario).

G. Hattersley-Smith. Journal of Glaciology, Vol 8, No 52, p 23-50, February 1969. 16 fig, 38 ref.

Descriptors: \*Glaciers, \*Regimen, \*Arctic, \*F-jords, \*Glaciation, Movement, Climates, Water balance, Surveys, Paleoclimatology. Identifiers: \*Ellesmere Island.

The former ice cover of northern Ellesmere Island was very much more extensive than the present, although the age of maximum glaciation is not known. In the Tanquary Fiord area this conclusion is based on bathymetric data indicating considerable overdeepening of the fiords, morphology of the main valleys, and the presence of moraines, erratics and glacial lake deposits at high levels. Tanquary Fiord became free of glacial ice at least 6,500 years ago and peat was forming in the valleys by this time. A long period of river erosion followed the main retreat of the ice. Subsequently, and within the last 4,000 years, glaciers advanced to reoccupy V-shaped valleys, and at the same time small ice caps were probably regenerated. In the last 900 years, however, there has been little change in the terminal position of most of the major glaciers, which appear to be advancing slightly, although in the last 40 years the side glaciers have receded from well-marked terminal moraines. (Knapp-W72-01400

#### REGIME OF AN AFGHAN GLACIER.

Newcastle-upon-Tyne Univ. (England). Dept. of Geography.

O. Gilbert, D. Jamieson, H. Lister, and A. Pendlington

Journal of Glaciology, Vol 8, No 52, p 51-65, February 1969. 11 fig, 3 tab, 10 ref.

Descriptors: \*Glaciers, \*Regimen, \*Water balance, \*Heat budget, \*Climates, Melting, Snow-fall, Glaciation, Solar radiation, Evaporation, Convection, Water supply, Water yield, Mountains, Topography. Identifiers: \*Afghanistan, Snow line.

The climatic snow line is a little above the highest peaks in the Mir Samir region of Afghanistan, but steep north-facing slopes provide a topographic reason for small glaciers persisting, with a snow line a little below 4,900 m. Snow accumilation at this height averages 1,300 kg per sq m, most of this falling in late winter and spring. Gross ablation reaches 40 kg per sq m per day. Net ablation (July-August), measured as stream discharge, averages 3,600 cu m per day. Slow recession is the average condition. Halt stages at 4,800, 4,600, and 4,000 m were interpreted from the topography. Dating of moraines by lichen distribution indicates (for the highest moraine) a minimum age of 400 years. The vertical flux of heat and of water vapor were calculated through an air layer 30-100 cm over a melting firn surface for 24 h. The source of heat available at the surface expressed as a percentage of the total was: net radiation 87, condensation 5, forced convection 1, conduction through snow 6, and unex-plained 1. The heat sink was: long-wave radiation 4%, evaporation 6% forced convection 6%, conduction into snow 2%, and melting 82%. (Knapp-USGS).

THE RESISTOGRAPH AND THE COMPRES-

SIVE STRENGTH OF SNOW. Montana State Univ., Bozeman. Dept. of Earth C. C. Bradley

Journal of Glaciology, Vol 7, No 51, p 499-506, October 1968. 4 fig, 3 tab, 4 ref.

Descriptors: \*Snowpacks, \*Compressive strength, \*Shear strength, \*Avalanches, \*Instrumentation, Stress, On-site tests, Compaction. Identifiers: \*Snow resistograph.

The snow resistograph is a field instrument designed for the rapid in situ measurement of snow strength. It consists of a probe with a horizontal bit at the bottom. The probe is pushed vertically down to the base of the snowpack, rotated 90 deg, and withdrawn. The resistance to upward movement encountered by the bit is balanced by a spring in the handle and thereby transmitted to a scribe.

Data are recorded on a roll of paper unwinding at a rate controlled by the rate of withdrawl of the probe. The graph (resistogram) thus produced shows resistance as a function of snow depth. On the assumption that the force necessary to move the bit upward is essentially the same as the force required to break the snow at that depth, the graph comes a strength profile (except in the 10 cm disturbed portion at the base of the pack). The working scale for the resistograms is derived by dividing the force by the area of the top silhouette of the bit. A recent field comparison of snow strength as measured by the snow resistograph and compressive strength as measured by direct loading to failure indicates good agreement in the range 25-400g/sq cm. (Knapp-USGS) W72-01402

#### THE HYDROLOGY OF SNOW AND ICE, Michigan Univ., Ann Arbor. Dept. of Geography. For primary bibliographic entry see Field 02A. W72-01440

# FEATURES OF THE RECEDING STAGE OF THE SHKHEL'DA GLACIER (OSOBENNOSTI OTSTUPANIYA LEDNIKA SHKHEL'DY),

Moscow State Univ. (USSR). Lab. of Aerial Photography; and Moscow State Univ. (USSR). Research Lab. for Snowslides. F. V. Nikulin, and Ye. S. Troshkina. Vestnik Moskovskogo Universiteta, Seriya V, Geografiya, No 4, p 76-82, July-August 1971. 3 fig. 7 ref.

Descriptors: \*Glaciers, \*Glaciation, \*Glacial drift, Ice, Snow, Avalanches, Debris avalanches, Landsides, Rockslides, Ablation, Pine trees, Surveys. Identifiers: \*USSR, \*Caucasus, \*Glacial recession, Glacial movement, Glacial retreat, Ablation moraine, Theodolites.

Unlike other glaciers of the Caucasus, the Shkhel'da Glacier is slow to recede. The glacier is 8.7 sq km in area, 10 km long, and has an average surface gradient of 7 deg. Its recession, which began in 1925-1927, is marked by a small decrease in length (150 m), a small reduction in area (15%), a slight lowering of the glacier surface (30 m), a 2.2-fold increase in the degree of surface dissection, an in-crease in the surface slope, a reduction in the rate of movement, and a formation of dead ice. The appearance of pine trees on the moraine points to the absence of ice movement in the lower part of the absence of ice movement in the lower part of the glacier. Appreciable accumulations of 0.2- to 0.3-m-thick ablation moraine and large rock fragments and debris on the surface have preserved the ice and have influenced the glacial movement during the period of observation (1911-1959). Repeated phototheodolite surveys will provide a reliable and convenient means of documenting the evolution of glaciers of this type. (Josefson-USGS) W72-01545

### RELATION OF RUNOFF DISTRIBUTION OF MOUNTAIN RIVERS IN A WARM PERIOD TO

VARIOUS SOURCES OF FLOW (ZAVISIMOST RASPREDELENIYA STOKA GORNYKH REK V TEPLYY PERIOD OT VIDOV PITANIYA), Moscow State Univ. (USSR). Chair of Hydrology. For primar j bibliographic entry see Field 02E. W72-01546

#### 2D. Evaporation and Transpiration

#### A RESISTANCE MODEL OF EVAPORATION

DURING SPRINKLING, Technion - Israel Inst. of Tech., Haifa. Ido Seginer.

Agr Meteorol. 7 (6): 487-497. Illus. 1970. Identifiers: Balance, Energy, Equation, Evapora-tion, Model, Resistance, Sprinkling.

A previous resistance model of sprinkler evapora-tion is expanded by considering 2 energy balance equations: one for the drops and another for the air layer where the evaporation takes place. To solve for the various fluxes, only the boundary conditions and the resistance of the system must be given. A comparison of calculations with experimental results, indicates good agreement for the limiting case of a wet surface with no drops in the air. The model predicts small spray evaporation under nor-mal operating conditions. The effects of water temperature, fitness of spray and application rate on the evaporation losses may be significant, if the variation of any of these parameters is within wide limits.—Copyright 1971, Biological Abstracts, Inc. W72-01195

#### EFFECT OF MINERAL FERTILIZERS ON WATER REGIME AND YIELD OF COTTON (IN RUSSIAN).

For primary bibliographic entry see Field 03F. W72-01211

#### AN ENERGY BUDGET APPROACH TO THE STUDY OF WATER LOSS IN CRYPTOGAMS, South Dakota Univ., Vermillion. Dept. of Biology. George R. Hoffman, and David M. Gates.

Bull Torrey Bot Club. 97 (6): 361-366. Illus. 1970. Identifiers: Budget, Cryptogams, Energy, Flux, Loss, Parmelia-Conspersa, Radiation, Reboulia-Hemisphaerica, Transpiration.

Evaporative water loss in the foliose lichen, Par-melia conspersa and the marchantiaceous liver-wort, Reboulia hemisphaerica was examined in the context of a total energy exchange between the plant and its environment (disregarding metabolism). Transpiration proceeds rapidly from moist plants and resistance is very low. As transpiration decreases, the relative importance of both convection and reradiation as energy dissipating mechanisms increases. Additionally, since both organisms lack effective means of controlling transpiration, resistance increases in proportion to the decreased water loss. Parmelia dried quickly under a total radiation flux of 3.0 cal cm-2 min-1. Reboulia transpired water over 2 hr under a radiation regime of 2.6 to 2.8 cal cm-2 min-1. The energy budget approach used here is both useful and desirable in studying water loss in cryptogams.—Copyright 1971, Biological Abstracts, Inc. W72-01309

# PHOTOSYNTHESIS AND TRANSPIRATION OF BANANA LEAF SAMPLES IN A CONTROLLED ENVIRONMENT,

Cameroons Development Corp., Ekona. Research Unit.

Ont.

B. M. Aubert, and J. Catsky.

Trop Ecol. 10 (2): 256-269. Illus. 1969.

Identifiers: Banana-M, Control, Controlled, Distribution, Environment, Evaporation, Leaf, Moisture, Opening, Photosynthesis, Samples, Stomatal, Transpiration.

Photosynthesis and transpiration were measured in the laboratory by means of an IR CO2 analyzer and

#### Group 2D-Evaporation and Transpiration

a dew-point recorder on banana leaf samples. Relative humidity effects on stomatal resistance, photosynthesis and transpiration were studied under a light intensity of 85.9 watt m-2, CO2 concentration of 300 ppm and a temperature averaging 27 C. Stomatal behavor and consequently photosynthesis and transpiration appears closely related to the moisture status of the leaf. The stomatal opening has a rhythm which is controlled by the marked conditions of evaporation prevailing around the leaf and by the actual supply of water. Two models of stomatal regulation were found, which provide some explanation for the large distribution of bananas in the world ranging from tropical heavy rain climates to mediterranean conditions.—Copyright 1971, Biological Abstracts, Inc. W72-01322

OBSERVATIONS OF SOIL EVAPORATION AND PLANT TRANSPIRATION IN AN ESTUA-RY IN WEST KAZAKHSTAN (NABLYUDENIYA NAD ISPARENIYEM S POCHVY I TRANS-PIRATSIYEY RASTITEL'NOSTI LIMANA V ZAPADNO-KAZAKHSTANSKOY OBLASTI), Laboratory of Limnology, Leningrad (USSR) For primary bibliographic entry see Field 02H. W72-01413

EVAPORATION AND TRANSPIRATION, Colorado Univ., Boulder. Inst. of Arctic and Alpine Research. For primary bibliographic entry see Field 02A.

SOME ASPECTS OF THE CLIMATIC DIS-TRIBUTION AND VARIATIONS OF PRECIPITATION IN THE WESTERN UNITED STATES AND BAJA CALIFORNIA, California Univ., Los Angeles. Water Resources

Research Center. C. B. Pvke.

W72-01439

University of California, Department of Meteorology, Tentative Outline of Doctoral Dissertation, November 1970. 29 p, 10 fig. OWRR A-021-CAL

Descriptors: \*Precipitation (Atmospheric), \*Climatology, \*United States, \*California, \*Pacific Northwest U.S., Meteorology, Storms, Thunderstorms, Winter, Summer, Spring, Arid lands, Extratropical cyclones, Convection, Air Masses, Maidway Moisture. Identifiers: \*Baja California.

Three prominent seasonal precipitation maxima are examined for western United States and Baja California. Winter maximum occurs in coastal and most interior sections. Summer maximum occurs in interior deserts and in Baja California. Late Spring maximum occurs in the interior of the Pacific Northwest. Winter maximum is the most important and extensive, and is associated with extratropical cyclones of the north Pacific Ocean.Summer maximum results from convective activity in warm unstable air masses. Lake Spring maximum results from Pacific moisture carried inland across the cascades by westerly winds. There are no climatic changes which signify permanent trends within the past 120 years; there appear to be no regular long-term climatic periodicities. (Popkin-Arizona) W72-01447

TRANSPIRATIONAL WATER LOSS AND ENERGY BUDGETS OF SELECTED PLANT

Missouri Botanical Garden, St. Louis. G. R. Hoffman, and D. M. Gates. Oecologia Plantarum, Vol 6, No 2, p 115-131, 1971. 5 fig, 4 tab, 11 ref.

Descriptors: \*Cooling, \*Transpiration, \*Convection, \*Radiation, \*Plant physiology, Temperature, Water balance, Mode of action, Energy budget, Heat transfer, Cotton, Heat stress, Heat balance, Water loss.

Transpiration is one mechanism by which plants dissipate heat, but they also lose heat by reradiation vonvection. The importance of transpiration as a plant cooling device has been the subject of some controversy and this paper presents evidence con-cerning the process. Using an equation especially developed for calculating transpirational water loss, radiation absorbed and energy dissipated for a whole plant, the energy was analyzed and the role of transpiration determined. All calculations were made under the assumption of steady state conditions. Under temperate conditions, reradiation accounted for almost 2/3 of total energy dissipated, while transpiration and convection accounted for 1/3. But, when air temperature was high and wind speed was low, reradiation in cotton was 38-61% of total heat dissipation, while transpiration accounted for 20-62%, with convectional factors being insignificant. (Casey-Arizona) W72-01452

WATER AND ENERGY RELATIONS OF PLANT LEAVES DURING PERIOD OF HEAT STRESS, Missouri Botanical Garden St. Louis: and Washington Univ., St. Louis, Mo. Dept. of Biology. For primary bibliographic entry see Field 02I. W72-01454

CONTROLLING INTERNAL PLANT WATER BALANCE THROUGH MICROCLIMATE BALANCE THROUGH MANIPULATION,

Michigan State Dept. of Univ., East Lansing. Dept of Horticulture. For primary bibliographic entry see Field 03F. W72-01458

#### 2E. Streamflow and Runoff

ADEQUACY OF MARKOVIAN MODELS WITH CYCLIC COMPONENTS FOR STOCHASTIC STREAMFLOW SIMULATION, Instituto Venezolano de Investigaciones Cien-

For primary bibliographic entry see Field 02A. W72-01123

SOME PROBLEMS OF FLOOD ANALYSIS, Colorado State Univ., Fort Collins. Engineering Research Center. For primary bibliographic entry see Field 04A. W72-01124

FLOOD ROUTING IN CHANNELS WITH BANK SEEPAGE, Virginia Polytechnic Inst. and State Univ.,

Blacksburg. For primary bibliographic entry see Field 04A. W72-01142

CIS AND TRANS LINKS IN NATURAL CHAN-

NEL NETWORKS, IBM Watson Research Center, Yorktown Heights, N.Y. For primary bibliographic entry see Field 04A. W72-01143

ESTIMATION OF UNCONFINED GROUND WATER FLOW TO DITCHES,
Dievd. Technikon Ypiresion, Ioannina (Greece).

For primary bibliographic entry see Field 04A. W72-01149

CHARACTERISTICS OF FLOW OVER WEIRS OF FINITE CREST WIDTH, Indian Inst. of Tech., Kanpur. Dept. of Civil En-

gineering.
For primary bibliographic entry see Field 08B. W72-01163

EFFECT OF PERIOD OF RECORD ON FLOOD PREDICTION,

Barr Engineering Co., Minneapolis, Minn. For primary bibliographic entry see Field 04A. W72-01166

INSTANTANEOUS UNIT HYDROGRAPH ANALYSIS HAWAIIAN ANALYSIS OF WATERSHEDS, SMALL. Honolulu. Water Resources

Hawaii Univ., Research Center.

Research Center.
Ru-Yih Wang, I-pai Wu, and L. Stephen Lau.
Available from the National Technical Information
Service as PB-204 549, \$3.00 in paper copy, \$0.95
in microfiche. Hawaii University, Water Resources Research Center Technical Report No 42, (Hawaii Agric. Exper. Sta. Journal Series No 1259), August 1970. 54 p, 17 fig, 4 tab, 17 ref, 2 append. OWRR Project B-003-HI (2).

Descriptors: \*Hawaii, \*Precipitation (Atmospher-ic), \*Surface runoff, \*Rainfall-runoff relationships, \*Unit hydrographs, Hydrograph analysis, Rainfall intensity, Hydrologic cycle, Storm runoff, Small watersheds, Drainage systems, River systems, Streamflow forecasting, Peak discharge, Discharge measurement, Deltas. Identifiers: \*Oahu (Hawaii).

An analysis of 240 hydrographs of 29 small watersheds on Oahu shows some unique hydrologic characteristics. Many of these watersheds are small, some measuring less than 5 squard miles, and they have extreme variations in rainfall. Between 4 and 15 single-peak hydrographs were collected for each watershed. The Instantaneous Unit Hydro-graph was more adaptable for ocean island conditions such as the Hawaiian Islands, and each individual watershed could be treated by computers. In analyzing these flood hydrographs, hydrologic characteristics such as small area, flush peak, short time to peak, and recession constant, were calculated. Time to peak, which is affected by a combination of storm and watershed characteristics, varied within short distances, as well as between basins. Average rainfall duration ranged from a minimum of 5 minutes to a maximum of 1 hour a over a 100 year period. A good correlation was found to exist between effective rainfall duration and the watershed area. (Glasby-USGS) W72-01375

LOW-FLOW MEASUREMENTS OF NORTH CAROLINE STREAMS,

Geological Survey, Raleigh, N.C. For primary bibliographic entry see Field 07C. W72-01379

WATER RESOURCES DATA FOR TEXAS, 1970 - PART 1. SURFACE WATER RECORDS. Geological Survey, Austin, Tex. For primary bibliographic entry see Field 07C. W72-01380

REDUCTION OF URBAN RUNOFF PEAK FLOWS BY PONDING,
Rice (Leonard) Consulting Water Engineers,

Denver, Colo. For primary bibliographic entry see Field 04A. W72-01421

FLOODS OF DECEMBER 1964 AND JANUARY 1965 IN THE FAR WESTERN STATES - PART

1965 IN THE FAR WESTERN STATES - PART 1. DESCRIPTION, Geological Survey, Washington, D.C. A. O. Waananen, D. D. Harris, and R. C. Williams. Available from Sup Doc, GPO, Washington, D C 20402 - Price \$1.25. Geological Survey Water-Supply Paper 1866-A, 1971. 265 p, 53 fig, 20 tab, 28 ref.

Descriptors: \*Floods, \*Streamflow, \*Sediment transport, \*Runoff, \*Pacific Northwest U S, California, Idaho, Nevada, Oregon, Washington,

#### Groundwater-Group 2F

Flood damage, Flood control, Precipitation (Atmospheric), Suspended load, Sediment yield, Columbus River, Great Basin, Rivers, Tributaries, Hydrologic data, Data collections, Stream gages, Flow rates, Peak discharge.
Identifiers: \*Flood data. Flood measurements

The floods of December 1964 and January 1965 in the Far Western States were extreme; in many areas, the greatest in the history of recorded streamflow and substantially greater than those of December 1955. An unusually large area--Oregon, most of Idaho, northern California, southern Washington, and small areas in western and northern Nevada--was involved. This report presents a general description of the December 1964 and January 1965 floods, details and estimates of the damage incurred, a summary of peak The floods of December 1964 and January 1965 in mates of the damage incurred, a summary of peak stages and discharges and comparative data for previous floods at 1,240 sites, and a summary of suspended-sediment concentrations and daily sedi-ment loads at 109 sites. Also included are discussions of the storm precipitation during the 2-month period, sedimentation, flood regulation by storage reservoirs and recurrence intervals of peak discharges, as well as tables of flood-crest stages along the San Joaquin, Sacramento, Russian, and Eel Rivers in California, and the Williamette River in Oregon. The greatest concentrations of suspended sediment occurred in streams that drained areas bordering the lower Snake and lower Columbia Rivers. Maximum concentrations in four of these streams ranged from 220,000 to 360,000 ppm. (Woodard-USGS) W72-01430

INTRODUCTION TO PHYSICAL HYDROLO-

For primary bibliographic entry see Field 02A. W72-01433

THE BASIN HYDROLOGICAL CYCLE, Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering. For primary bibliographic entry see Field 02A. W72-01436

RELATION OF RUNOFF DISTRIBUTION OF MOUNTAIN RIVERS IN A WARM PERIOD TO VARIOUS SOURCES OF FLOW (ZAVISIMOST) RASPREDELENIYA STOKA GORNYKH REK V TEPLYY PERIOD OT VIDOV PITANIYA),

Moscow State Univ. (USSR). Chair of Hydrology.

I. S. Fedorova.

Vestnik Moskovskogo Universiteta, Seriya V, Geografiya, No 4, p 95-98, July-August 1971. 2 fig,

Descriptors: \*Runoff, \*Streamflow, \*Rivers, \*Orography, Altitude, Precipitation (Atmospheric), Seasonal, Glaciers, Glaciation. Identifiers: \*USSR, \*Mountain rivers, Caucasus, Altay Territory, Central Asia, Tien Shan, Pamirs, Glacial runoff, Variation coefficient.

Glacier-fed mountain rivers of the Caucasus, Altay and Central Asia were examined to study the ef-fects of various sources of flow on the distribution rects of various sources of flow on the distribution of runoff within a warm period. The ratio of the April-June runoff to the July-September runoff (ranging from 0.20 to 2.00) decreases with altitude and is inversely proportional to the glacial component of streamflow. To show the effect of the rainfall component of streamflow and the distribution of precipitation within a warm period on the ratio of the April-June to July-September runoff, graphs were constructed to correlate the glacial contribution in percent of annual runoff to (1) the contribution in percent of annual rule of (1) derivation for April-June to the precipitation for July-September; and (3) the ratio of precipitation for October-June to the precipitation for July-September. By knowing the ratio of precipitation within the April-September warm period and the magnitude of glacial runoff, it is possible to determine the ratio of the April-June to July-September runoff for ungaged rivers. (Josefson-USGS)

W72-01546

FORMULATION OF MATERSHED-FLOW MODEL FORMULATION MATHEMATICAL Utah State Univ., Logan; and Illinois Univ., Ur-

For primary bibliographic entry see Field 06A. W72-01587

HOW NATURAL IS THE GREEN RIVER,

N. Junan.
J Colo Wyo Acad Sci. 7 (1): 1970.38.
Identifiers: Geology, Green, Human, Natural,
River, Vegetation, Wyoming.
W72-01615

INCORPORATION OF PRECIPITATION DATA IN STOCHASTIC SIMULATION OF MONTHLY STREAMFLOWS,

Nevada Univ., Reon. Center for Water Resources Research.

Report presented at the Fall National Meeting of the American Geophysical Union, San Francisco, December 1970. 21 p, 7 fig, 2 tab, 7 ref. 14-01-0001-1922.

Descriptors: Precipitation (Atmospheric), \*Ru-noff, Flow, Simulation, Optimization, Monthly, Stochastic processes, Nevada, Model studies, Estimating, Statistical methods.
Identifiers: Eel River (Nev), Multiple regression

A multiple regression model for simulation of monthly flows is developed in which both precipita-tion and runoff are included. Incorporation of precipitation in three time phases, namely current, previous month, and accumulated precipitation in the regression function, represents more adequately the relationship between precipitation and ru-noff. It also reduces the uncertainties involved in the flow estimates expressed in terms of variance and coefficients of variability. As precipitation records, like streamflows, are also available only for limited periods, additional precipitation data are supplied by a generating procedure to be used later in the streamflow simulation model. The underlying frequency distributions of the natural streamflow series are explored and imposed on the simulation model to increase the resemblance with historic events. The principal contributors to runoff may differ from month to month according to the season and the physiographic characteristics of the basin. A statistical analysis is applied which leads to the optimal combination of variables taking part in the regression function each month. By recognizing the main causes effecting runoff in the generation model, a major reduction of the stochastic com-ponent inherent in simulation models of this type is achieved. Results obtained by applying the suggested model to three basins in western United States verify the validity of this approach. (See also W71-07334) W72-01639

#### 2F. Groundwater

HYDROGEOCHEMISTRY (GIDROGEOK-For primary bibliographic entry see Field 02K. W72-00810 HIMIYA),

APPLICATION OF A LOCAL SIMILARITY CONCEPT IN SOLVING THE VERTICAL SUB-SURFACE FLOW PROBLEM,

National Center for Atmospheric Research, Boulder, Colo.

R. L. Drake, and C. P. Peterson. Water Resources Research, Vol 7, No 5, p 1241-1255, October 1971. 18 fig, 1 tab, 14 ref.

Descriptors: \*Mathematical studies, Continuity equation, Equations, Groundwater movement, Infiltration, Approximation method, Numerical analysis, Estimating, Mathematical models. Identifiers: Continuum mechanics.

Similarity transformations may be used even when all the requirements for the application of such transformations are satisfied. The transformed equations usually involve a stray time variable that equations usually involve a stray time variable that is interpreted as a system parameter. When this parameter is properly interpreted, the solutions of the transformed systems are very good numerical approximations for the solutions of the original systems. The advantages of considering the transformed systems are usually two-fold: numerical solutions can be obtained with less computer time, and conditions can be obtained with less computer time, and conditions can be obtained. and qualitative analysis of the transformed systems is usually easier than that of the original systems. A local similarity concept may be used in solving evolution-type problems in continuum mechanics, including the Fokker-Planck equation of vertical subsurface flow. (Knapp-USGS) W72-01135

DRAINAGE OF GROUNDWATER RESTING ON A SLOPING BED.

Cambridge Univ. (England). Dept. of Agricultural Science; and Cambridge Univ. (England). Dept. of Applied Biology. E. C. Childs.

Water Resources Research, Vol 7, No 5, p 1256-1263, October 1971. 5 fig, 1 tab, 11 ref.

\*Dupuit-Forchheimer Descriptors: theory. Aquicludes, \*Slopes, Drainage, Groundwater movement, Hydraulic gradient, Water levels, Mathematical studies.

The Dupuit-Forchheimer convention for horizontal impermeable beds states that the gradient of hydraulic potential is synonymous with the ab-solute slope of the water table. When the impermeable bed is sloping, however, the gradient is normally better approximately by dZ/dl, where l is the distance measured along the bed and Z is the height of the intersection with the water table of the per-pendicular through I. Thus the solution of the resulting flow equation for drainage to a transverse ditch in the absence of surface recharge provides a family of branched curves for different slopes, instead of the single branched curve currently accepted. (Knapp-USGS)
W72-01136

AN AUTOMATIC SOLUTION FOR THE IN-VERSE PROBLEM,

Ecole Nationale Superieure des Mines de Paris, Fontainbleau (France). Lab. of Mathematical

Hydrogeology. Y. Emsellem, and G. De Marsily. Water Resources Research, Vol 7, No 5, p 1264-1283, October 1971. 14 fig, 3 tab, 38 ref.

Descriptors: \*Groundwater movement, \*Surface-groundwater relationships, \*Mathematical studies, \*Mathematical models, Computer programs, Equations, Water table, Groundwater, Numerical analysis, Transmissivity, Permeability, Digital computers. Identifiers: Inverse problem.

Computing of the estimated hydraulic parameters of an aquifer when the data consist of the piezometor an adulter when the data consist or the piezometric head and the flow rates of the wells (the "inverse problem") is a good example of an improperly posed problem, if only its mathematical part is to be solved. Yet if the available physical information about the structure of the desired solution is used, the problem becomes properly posed mathemati-cally. The desired solution is the regional distribu-tion of the hydraulic parameters and is consequently the best mathematical solution. As the mathematical problem improves, a practical way is needed to obtain the best estimate of the hydraulic parameters from actual measures, which always in-clude errors. A solution of these two problems is given. The importance of the method is threefold: (1) It gives an estimate of the permeability that is

#### Group 2F-Groundwater

consistent with all the assumptions and nothing but working assumptions. (2) It makes it possible to detect the sectors in which the data are imprecise of missing or the assumptions incorrect. (3) It rapidly and cheaply furnishes a working instrument. (K-napp-USGS) W72-01137

DEVELOPMENT AND DISTRIBUTION OF PERMEABILITY IN CARBONATE AQUIFERS, Geological Survey, Raleigh, N.C.

H. E. LeGrand, and V. T. Stringfield. Water Resources Research, Vol 7, No 5, p 1284-1294, October 1971. 2 fig, 1 tab, 23 ref.

Descriptors: \*Aquifer characteristics, \*Carbonate rocks, \*Fractures (Geology), \*Water circulation, \*Water chemistry, Carbon dioxide, Solubility, Permeability, Porosity, Transmissivity, Water table, Water levels, Groundwater movement, Karst, Limestones, Subsurface drainage, Hydrogeology. Identifiers: \*Carbonate aquifers.

Unlike aquifers in nonsoluble rocks in which the permeability tends to be fairly even in local distribution, aquifers in carbonate rocks tend to have their permeability developed through circulation of water and solution of the rock and to have a coarse and uneven distribution of permeability. Their permeability depends on the degree to which water with dissolved carbon dioxide has moved through joints and other openings. The circulation of water and solution activity tend to be greatest in the upper part of the zone of saturation and tend to lessen with increased depth. The moderately large openings in the path of bulk flow of groundwater tend to enlarge by solution action; contrastingly, the small openings not in the path if bulk flow enlarge only slightly. The dynamic water table is bounded above by a cavernous unsaturated zone that is a relic of the former permeable zone of saturation. With time, the solution channel network loses its aquifer characteristics when (1) the water table moves downward to the base of the aquifer, (2) the cavernous rocks are destroyed by erosion, or (3) the aquifer becomes buried and lies below the groundwater circulation system. The history of some carbonate aquifers includes early development under water table conditions, burial and preservation under later deposits, ressurection, and reactivation in the modern groundwater circulation system. (Knapp-USGS) W72-01138

GROUNDWATER FLOW IN A SANDY TIDAL BEACH: (1) ONE-DIMENSIONAL FINITE ELEMENT ANALYSIS.

Erindale Coll. (Ontario). W. Harrison, C. S. Fang, and S. N. Wang. Water Resources Research, Vol 7, No 5, p 1313-1322, October 1971. 6 fig., 1 tab, 17 ref.

Descriptors: \*Groundwater movement, \*Benches, \*Water level fluctuations, \*Tides, \*Numerical analysis, Mathematical models, Time series analysis, Tidal effects, Hydraulic conductivity, Porosity, Statistical methods.

Identifiers: Finite element method.

Beach water table and tidal fluctuations were observed for 31 days in 13 wells along a profile perpendicular to the shoreline at Virginia Beach, Virginia. Finite element techniques were applied to solve the one-dimensional, unsteady state, non-linear equations for groundwater movement. For the finite element analysis, the semi-infinite mass (unconfined aquifer) had to be replaced by a finite mass. The boundary conditions were found from the field data by directly solving the flow equation with a finite difference technique. The finite element method, using the variational principle, provided a reasonable solution, economical in computer time. (Knapp-USGS)

PROJECTING OF DARCY'S LAW AS RELATED TO THE ELLIPSE OF DIRECTION, Nevada Univ., Reno. Desert Research Inst.

Nevada Univ., Reno. Desert Research Ins C. M. Case.

Water Resources Research, Vol 7, No 5, p 1354-1356, October 1971, 6 ref.

Descriptors: \*Darcy's law, \*Mathematical studies, \*Permeability, Anisotropy, Velocity, Groundwater movement, Aquifer characteristics. Identifiers: Permeability tensor.

The concept of projecting the tensor form of Darcy's law is a given direction is examined mathematically. The conclusions drawn for this analysis are (1) the projections in a given direction of each term in the tensor expression for Darcy's law cannot in general be assembled to give a valid expression for Darcy's law, and (2) an ellipse of direction cannot be used to find the projection of the permeability tensor at a point in any direction other than that parallel to the resultant velocity at that point. (Knapp-USGS) W72-01145

ANALYSIS OF GROUND-WATER SYSTEM IN ORANGE COUNTY, CALIFORNIA, BY USE OF AN ELECTRICAL ANALOG MODEL,

Geological Survey, Menlo Park, Calif. W. F. Hardt, and E. H. Cordes. Geological Survey Open-file Report, May 28, 1971. 60 p, 24 fig, 3 tab, 20 ref.

Descriptors: \*Water resources development, \*Groundwater, \*Groundwater movement, \*Mode studies, \*California, Analog models, Electric currents, Analytical techniques, Withdrawal, Pumping, Groundwater recharge, Saline water intrusion, Coastal plains, Water yield, Water quality, Water users, Aquifers, Aquifer characteristics, Water level fluctuations, Hydrologic data. Identifiers: \*Orange County (Calif).

The Orange County electrical analog study area is in the coastal basin of southern California, about 25 miles southeast of Los Angeles. Thick alluvial aquifers contain large quantities of groundwater within the basin. Runoff from the surrounding mountains enters several streams that drain to the Pacific Ocean. Recharge enters the aquifers from stream percolation, direct percolation of rain, and irrigation return. Water pumped from wells is for agricultural, industrial, urban, and municipal use. The population and economic growth of Orange County since 1950 has increased the demand for water. Specific problems include sea-water intrusion from the Pacific Ocean, groundwater basin overdraft, land subsidence, unfavorable pumping patterns, water-quality degradation, and control of artificial recharge practices; these problems must be solved in ways compatible with water uses for agriculture, industry, and public supplies, in order to provide maximum benefit to all users. Results of various model runs under different hydrologic assumptions and various assumed parameters indicate similarity with actual conditions; the cause and effect relations simulated are reasonable but agree only on a gross scale. (Woodard-USGS) W72-01155

For primary bibliographic entry see Field 04B. W72-01256

MATHEMATICAL MODELING OF FRESH-WATER AQUIFERS HAVING SALT-WATER BOTTOMS,

General Electric Company, Santa Barbara, Calif. Tempo.

Available from the National Technical Information Service as PB-204 545, \$3.00 in paper copy, \$0.95 in microfiche. 71 TMP-47, July 1971. 68 p, 1 fig, 9 ref, 2 append. OWRR C-1875- (3175) (3).

Descriptors: \*Computer models, \*Saline water-freshwater interfaces, \*Dispersion, \*Aquifers, \*Groundwater, Salinity, Flow.

A method is described for modeling the flow and salinity of water in an aquifer which has a fresh water lens overlying saltwater. Dispersion of salts across the interface is taken into account. The flow model is for general two-dimensional horizontal flow in an aquifer which can be either confined or unconfined at each horizontal location and can change character as the water level changes. Some preliminary calculations are described. A bibliography of the literature on freshwater-saltwater combined flows is included as an appendix. W72-01342

POTENTIOMETRIC SURFACE AND AREAS OF ARTESIAN FLOW, MAY 1969, AND CHANGE OF POTENTIOMETRIC SURFACE 1964 TO 1969, FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, FLORIDA,

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W72-01374

SEA-WATER INTRUSION: AQUITARDS IN THE COASTAL GROUND WATER BASIN OF OXNARD PLAIN, VENTURA COUNTY.
California State Dept. of Water Resources, Sacra-

Available from State of Calif. Documents Section, PO Box 20191, Sacramento, Calif 95820-\$7.00. California Department of Water Resources Bulletin No 63-4, September 1971. 569 p, 65 fig, 17 tab, 69 ref, 4 append.

Descriptors: \*Groundwater movement, \*Aquitards, \*Aquifers, \*Porous media, \*California, Geologic formations, Aquifer characteristics, Hydrogeology, Permeability, Porosity, Water yield, Aggregates, Particle size, Pumping, Groundwater recharge. Identifiers: \*Groundwater (Ventura County Calif).

Field, laboratory and theoretical analysis define the role that aquitards play in controlling groundwater movement in the Oxnard Basin in Ventura County, California. Contrary to the usual concept that aquitards are effective confining beds, the beds in the Oxnard test area near Port Hueneme have a small but significant permeability. This basin is clearly a system of leaky aquifers. This was proven by a series of pumping tests and a ratio method of analyzing the field data. Using the ratio method, the aquitard overlying the Oxnard aquifer was found to have an average permeability of 0.025 gpd/sq ft. Core samples were studied with regard to composition, consolidation, permeability, and effects of replacing the natural pore fluids by salt water. The aquitard sediments are predominantly in the silt size and are mainly composed of quartz and clay minerals. The clay content is generally less than 20 percent and is dominantly montmorillonite with lesser amounts of kaolinite and illite. (Woodard-USGS)

LAKES OF THE SEMIARID ZONE OF THE USSR (OZERA SEMIARIDNOY ZONY SSSR), Laboratory of Limnology, Leningrad (USSR). For primary bibliographic entry see Field 02H. W72-01403

GROUNDWATER IN LAKE BASINS OF THE SARPINSKAYA DEPRESSION (GRUNTOVYYE VODY NEKOTORYKH OZERNYKH KOTLOVIN SARPINSKOY LOZHBINY), Laboratory of Limnology, Leningrad (USSR). For primary bibliographic entry see Field 02H. W72-01410

THE NATURAL ELECTRICAL FIELD AND GROUNDWATER MOVEMENT (YESTESTVENNOYE ELEKTRICHESKOYE POLE I FIL'TRATSIYA GRUNTOVYKH VOD), Laboratory of Limnology, Leningrad (USSR).

For primary bibliographic entry see Field 02H. W72-01411

A FINITE DIFFERENCE METHOD FOR ANALYZING LIQUID FLOW IN VARIABLY SATURATED POROUS MEDIA, Corps of Engineers, Davis, Calif., Hydrologic En-

gineering Center.
For primary bibliographic entry see Field 08E.
W72-01415

DEPTH TO GROUND-WATER TABLE BY REMOTE SENSING, Oklahoma State Univ., Stillwater. Dept. of Civil

Engineering.
For primary bibliographic entry see Field 07B.
W72-01420

**EXOTIC USES OF AQUIFERS,** 

Louisiana State Univ., Baton Rouge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04B.
W72-01422

A RECONNAISSANCE OF THE QUALITY OF WATER FROM IRRIGATION WELLS AND SPRINGS IN THE SNAKE PLAIN AQUIFER,

SCAUTHEASTERN IDAHO, Geological Survey, Boise, Idaho. For primary bibliographic entry see Field 04B. W72-01423

GROUNDWATER RESOURCES OF MONT-GOMERY COUNTY, TEXAS,

Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 04B.
W72-01427

GROUNDWATER RESOURCES OF RENVILLE

AND WARD COUNTIES, Geological Survey, Bismarck, N. Dak. W. A. Pettyjohn, and R. D. Hutchinson North Dakota Geological Survey Bulletin 50-Part III, and North Dakota Water Commission County Ground-Water Studies 11-Part III, 1971. 100 p, 31 fig, 2 plate, 8 tab, 48 ref.

Descriptors: \*Groundwater, \*Aquifer characteristics, \*Water yield, \*Water quality, \*North Dakota, Water resources development, Water wells, Hydrologic data, Data collections, Hydrogeology, Withdrawal, Drawdown, Groundwater recharge, Storage coefficient, Water utilization. tion.

Identifiers: \*Groundwater resources, \*Renville and Ward Counties (N Dak).

Two types of aquifers occur in Renville and Ward Counties, North Dakota-those in the semicon-solidated and consolidated bedrock formations and those in the unconsolidated glacial deposits. The Fort Union Group contains the most productive bedrock aquifers. Generally water from the Fort Union is a sodium bicarbonate type or a sodium chloride type. The water is unsuitable for irrigation and in many places is undesirable for domestic use.

Deposits of Quaternary age comprise the major aquifers with yields of more than 500 gpm of good quality water. The most productive aquifers are in the valleys of the Souris and Des Lacs Rivers. Well yields of more than 500 gpm are available from the Kenmare aquifer and locally from aquifers in the Souris River valley between Minot and Logan. Northwest of Minot and between Logan and Sawyer, yields of 50 to 500 gpm can be expected. Much of the water in the valley aquifers is suitable for domestic, municipal, and industrial uses. Substantial quantities of groundwater are stored in surficial sand and gravel deposits in ice-marginal chan-nels. In most places, the water had a specific con-ductance that is less than 1,000 micromhos. (Woodard-USGS) AN APPRAISAL OF GROUND WATER FOR IR-RIGATION IN THE WADENA AREA, CEN-TRAL MINNESOTA, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 04B. W72-01432

INTRODUCTION TO PHYSICAL HYDROLO-

For primary bibliographic entry see Field 02A. W72-01433

GROUND WATER,

Colorado State Univ., Fort Collins. Dept. of Geolo-

For primary bibliographic entry see Field 02A. W72-01434

POTENTIAL POLLUTION OF THE OGALLALA BY RECHARGING PLAYA LAKE WATER, Texas Tech Univ., Lubbock. Water Resources

Center. For primary bibliographic entry see Field 05B. W72-01462

HYDROGEOLOGY OF THE NISHNABOTNA RIVER BASIN, lowa State Univ. of Science and Technology,

Ames. Dept. of Earth Science. R. Stone.

Ph D Thesis, Iowa State University of Science and Technology, 1971. 179 p, 34 fig, 20 tab, 42 ref. OWRR A-030-IA (2).

Descriptors: \*Hydrogeology, \*Groundwater move-ment, \*Aquifers, \*Water resources development, \*Iowa, Aquifer characteristics, Water wells, Surface-groundwater relationships, Water yield, Withdrawal, Drawdown, Groundwater recharge, Water quality, Chemical analysis.
Identifiers: \*Nishnabotna River basin (Iowa).

The Nishnabotna River basin of southwestern Iowa is situated in a glacial terrain underlain by a bedrock valley system that contains pro-glacial sand and gravel. Topography controls the pattern sand and grave. Topography controls the pattern of groundwater flow near the basin divide but groundwater flow patterns within the basin respond to both surface topography and the subsurface geology. Exportation of groundwater from the basin at locations other than the surface outlet is limited to flow of about 500,000 gpd through the pro-glacial aquifer of a tributary bedrock valley. The major bedrock valley, the Fremont Channel, exerts strong potential drawdown effects within the basin. At the locations of horizontal divergence from the West Nishnabotna valley and horizontal convergence with it, the Fremont Channel exerts dominating potential drawdown with resulting flow of influent river water to it. River low-flow data yield small and negative reach incremental discharges at these locations. Mineral analysis of water samples are graphically summarized. Nitrate was detected in water from two wells with concentrations of 0.23 ppm and 1.91 ppm. (Woodward-USGS) W72-01520

GEOCHEMICAL RANGES OF TITANIUM MIGRATION IN GROUNDWATER (O GEOK-HIMICHESKIKH DIAPAZONAKH MIGRATSII TITANA V PODZEMNYKH VODAKH), All-Union Scientific Research Inst. of Hydrogeolo-

gy and Engineering Geology, Moscow (USSR). For primary bibliographic entry see Field 02K. W72-01547

A NEW METHOD FOR APPROXIMATE DETERMINATION OF AQUIFER PERMEABILITY (NOVYY METOD PRIBLIZHENNOGO OPREDELENIYA VODOPROVODIMOSTI VODONOSNYKH GORIZONTOV), Kiev State Univ. (USSR). N. I. Drobnokhod.

In: Materialy po geologii, gidrogeologii i geokhimii Ukrainy, Kazakhstana, Altaya i Zabaykal'ya: Kiev-skiy Gosudarstvennyy Universitet Nauchno-Iss-ledovatel'skiy Sektor, Sbornik Nauchnykh Rabot No 6, p55-57, 1970. 1 fig, 1 tab, 4 ref.

Descriptors: "Aquifers, "Permeability, "Specific yield, Hydrogeology, Groundwater, Groundwater movement, Dupuit-Forchheimer theory, Drawdown, Water table, Confined water, Steady flow, Sands, Boreholes, Pumping. Identifiers: "USSR.

A method is given for approximate calculation of the permeability of water-bearing materials based on the value of the reduced specific yield of a borehole. Reduced specific yield, as a charac-teristic of aquifer yield, is the amount of water in one meter of aquifer thickness (artesian or water-table) at drawdown equal to one-half of the total aquifer thickness. Reduced specific yield has none of the basic shortcomings of specific yield and, from the theoretical standpoint, is independent of drawdown. Formulas are cited for computing the drawdown. Formulas are cited for computing the permeability of artesian and water-table aquifers on the basis of pumping tests under conditions of steady flow. (Josefson-USGS) W72-01551

ON-SITE INVESTIGATIONS OF INFILTRA-TION (NATURNYYE ISSLEDOVANIYA FIL'-TRATSII),

For primary bibliographic entry see Field 02G. W72-01552

#### 2G. Water in Soils

RUNOFF PROCESSES DURING SNOWMELT. Agricultural Research Service, Danville, Vt. For primary bibliographic entry see Field 02C. W72-01126

SIMULTANEOUS SOLUTE AND WATER TRANSFER FOR AN UNSATURATED SOIL,

Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils. A. W. Warrick, J. W. Biggar, and D. R. Nielsen. Water Resources Research, Vol 7, No 5, p 1216-

1225, October 1971. 11 fig, 13 ref.

Descriptors: \*Unsaturated flow, \*Soil water movement, \*Ion transport, \*Aqueous solutions, \*Water chemistry, Path of pollutants, Sorption, Absorption, Mathematical models, Numerical analysis, Salts, Infiltration, Percolation, Mass transfer, Chlorides. Identifiers: Solute transfer.

The simultaneous transfer of solute and water dur-ing infiltration was studied both in the field and numerically. An apparent diffusion coefficient of about 0.07 sq cm/min provided maximum solute concentration values over a 17-hour period. The advance of a solute front with irrigation water is nearly independent of the initial soil moisture content but highly dependent on the moisture content but highly dependent on the moisture content maintained at the soil surface during infiltration. (Knapp-USGS)
W72-01132

EFFECT OF A FREEZING ZONE OF FINITE WIDTH ON THERMAL REGIME OF SOILS, Cold Regions Research and Engineering Lab., Hanover, N.H. For primary bibliographic entry see Field 02C. W72-01133

PHYSICAL SIMULATION OF INFILTRATION

Saskatchewan Univ., Saskatoon. Div. of Hydrolo-

gy. W. Lin, and D. M. Gray. Water Resources Research, Vol 7, No 5, p 1234-

#### Group 2G-Water in Soils

Descriptors: \*Infiltration, \*Mathematical models, \*Hydraulic models, \*Soil water movement, \*Percolation, Numerical analysis, Porosity, Fluid mechanics, Laminar flow, Hydraulic conductivity, Capillary action, Simulation analysis.

Laminar (capillary) flow method may be used for synthesizing the infiltration process on physical hydrologic models. The equations defining laminar flow in capillary tubes and between parallel plates were derived for several different ge cometric configurations representing horizontal, vertically downward, vertically upward, and radial flow. The theoretical equations for the different configurations are analogous in functional form to the theoretical and empirical infiltration equations used to define the time variation in the infiltration rate of a soil. The results from several tests conducted on capillary tubes were in close agreement with those obtained from the theoretical equations. (Knapp-USGS) W72-01134

OF THERMOCOUPLE APPLICATION PSYCHROMETERS TO SOIL WATER TRANS-

PORT, Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs. C. G. Enfield, and J. J. C. Hsieh.

Water Resources Research, Vol 7, No 5, p 1349-1353, October 1971. 4 fig, 1 tab, 9 ref. AEC Contract AT (45-1)-1830.

Descriptors: \*Soil water movement, \*Soil moisture meters, \*Water temperature, \*Hydraulic conductivity, \*Hydraulic gradient, Instrumentation, Infiltration, Groundwater recharge, Evapotranspira-

Identifiers: Thermocouple psychrometer.

The energy status (potential) of water can be used to calculate water flux. Thus, field measurement of water potential is superior to conventional gravimetric soil moisture content measurements for dynamic soil water studies and is useful for steady state analysis of soil water transport. Soil thermocouple psychrometers give sufficiently sensitive, in situ measurements of water potential to apply energy concepts to dynamic soil water move-Thus the soil thermocouple psychtometer can be used to obtain soil water potential informa-tion needed to determine the direction of water flow and the magnitude of the driving force. This technique is not limited to studies of the penetration of rainfall in the arid region but also has application in evapotranspiration studies, and might be adaptable to such studies as groundwater hazards of sanitary land fills. (Knapp-USGS) W72-01144

TENTATIVE STUDY OF THE WATER AND THERMAL REGIMES, THE REDOX POTENTIAL, AND THE LEACHING OF SUBSTANCES IN RED EARTHS (OPYT IZUCHENIYA VOD-NOGO, TEPLOVOGO REZHIMOV, OVP I VY-MYVANIYA VESHCHESTV V KRASNOZEMAKH), Akademiya Nauk SSSR, Moscow. Institut

A. I. Romashkevich, and L. A. Karmanova. Pochvovedeniye, No 2, p 41-54, February 1971. 4 fig. 6 tab. 14 ref.

Descriptors: \*Soil physics, \*Soil physical proper-ties, \*Soil chemical properties, \*Water balance, \*Heat balance, Leaching, Moisture content, Organic matter, Humus, Iron, Air temperature, Precipitation (Atmospheric), Seasonal, Oxidationreduction potential, Acidity, Hydrogen ion concentration, Bulk density, Porosity, Specific gravity,

tration, Bulk density, 1900ay, Special Soil temperature.

Identifiers: \*USSR, \*Red earths, Adzhar ASSR, Batumi Botanical Garden, Thermoisopleths, Chronoisopleths, Hygroscopicity.

Investigations were conducted in the Batumi Botanical Garden (Adzhar ASSR) in 1968-70 to study the moisture content of Red Earths under natural vegetation, and the temperature, oxidationreduction potential, and content of various sub-stances leached from the soil profile. The conditions in these soils were always favorable but not optimal for the intense transformation of organic and mineral substances. The hydrothermal and redox conditions in the Red Earths ensured a continuous removal of appreciable amounts of watersoluble organic matter and iron, whose movement in the subtropical landscape may be described as multistage 'diffusion.' (Josefson-USGS) W72-01168

SOIL MOISTURE MEASUREMENT BY THE CAPACITANCE METHOD (O IZMERENII POCHVY YEMKOSTNYM VLAZHNOSTI METODOM),

Belorusskii Nauchno-Issledovatelskii Institut Melioratsii i Vodnogo Khozyaistva, Minsk (USSR). D. S. Kuz'michev.

Pochvovedeniye, No 2, p 54-59, February 1971. 3 fig. 1 tab, 5 ref.

Descriptors: \*Soil moisture meters, \*Measurement, \*Instrumentation, \*Soil moisture, \*Moisture content, Soils, Soil properties, Soil density, Dispersion, Soil temperature, Hysteresis, Salts, Peat, Or-ganic matter, Sampling, Homogeneity, Volume. Identifiers: \*USSR, Brest Oblast, Gantsevichi Rayon, Sandy soils, Sensors, Soil dielectric proper-

A capacitance-type moisture meter has a measure-ment range in soils from air-dry to full moisture capacity. It was used to measure the moisture content of Peat and sandy soils of the 'Chudin' bog tract, Gantsevichi Rayon, Brest Oblast. It was found that the readings of the moisture meter depend upon the degree of soil dispersion and the content of organic matter in it. A variable salt concentration to within 1 g/liter has no effect on the instrument readings. The results of volume moisture measurements are independent of the soil density in the sensor. The root-mean-square error of 36 laboratory measurements of the volume moisture of homogeneous peat was plus or minus 2.1-2.6% and that of field measurements of inhomogeneous peat, plus or minus 3.86%. (Josefson-USGS) W72-01169

DEGREE AND DEPTH OF SOIL WETTING DURING CROP IRRIGATION (STEPEN' I GLU-BINA UVLAZHNENIYA POCHVO-GRUNTA PRI POLIVAKH SEL'SKOKHOZYAYSTVEN-NYKH KUL'TUR),

For primary bibliographic entry see Field 03F. W72-01170

METHOD OF DETERMINING THE SOIL MOISTURE POTENTIAL WITH A PRESSURE MEMBRANE APPARATUS (K METODIKE OPREDELENIYA POTENTSIALA VLAZH-NOSTI POCHV S PRIMENENIYEM MEMBRAN-NYKH PRESSOV), Vsesoyuznaya Akademiya Selskokhozyaistvennykh

Nauk, Moscow (USSR). Agrofizicheskii Nauchno-Issledovatelskii Institut.

A. M. Globus, S. K. Rozenshtok, V. M. Sirotkin, and B. N. Michurin.

Pochvovedeniye, No 2, p 141-149, February 1971. 3 fig, 1 tab, 4 ref.

Descriptors: \*Soil moisture meters, \*Ther-modynamics, \*Pressure, \*Soil moisture, \*Moisture content, Instrumentation, Entropy, Hysteresis, Equipment, Membranes, Equilibrium, Atmospheric pressure, Gases, Diffusion, Manometers, Chernozems, Loam.

nozems, Loam. Identifiers: \*USSR, \*Pressure membrane ap-paratus, Pressure membranes, Moisture capacity, Moisture potential.

The thermodynamic principles of the pressure membrane method used to determine the relation of the moisture potential and differential moisture capacity of soils to their moisture content are examined. The moisture potential is a component of the relative specific, partial free energy of soil moisture which depends upon the capillary-sorption properties of the soil. Two modifications of the pressure membrane apparatus developed by L.A. Richards (1947) are described: (1) a pressure-membrane apparatus for mass determinations of the moisture potential of soils with a recording of the changes in moisture content by weight; and (2) a pressure-membrane apparatus for investigating the relationship between the moisture potential and the moisture content of soils by volumetric recording of the change in moisture content. (Josefson-USGS) W72-01171

REPLICATION OF DETERMINATIONS OF MOISTURE CONTENT OF DRAINED SOILS (O POVTORNOSTI OPREDELENIYA NOSTI OSUSHENNYKH POCHV), Severnyi Nauchno-Issledovatelskii

Gidrotekhniki i Melioratsii, Kalinin (USSR). Kalinin Experimental Reclamation Station.

Pochvovedeniye, No 2, p 150-156, February 1971. 2 fig, 5 tab, 20 ref.

Descriptors: \*Soils, \*Soil moisture, \*Moisture content, \*Soil water, Podzols, Clay loam, Turf, Drainage, Sampling, Statistical methods, Probabili-

A relationship between the magnitude of the error of soil moisture determinations and the probability of it being exceeded, and the number of replications was established on the basis of a statistical analysis of 3 years of observations (1964-66) of Sod-Podzolic clay loam soils on the Olonets Plain of the Karelian ASSR. A critical evaluation was made of current methods for selecting the number of replications necessary for soil moisture determinations with a given degree of accuracy. An approximate method was proposed for establishing the number of replications needed for Sod-Podzolic clay loams with an even surface. (Josefson-W72-01172

CHANGES OF PH IN GYOGON PADDY SOILS UNDER WATER-LOGGED CONDITION, Agricultural Research Inst., Insein (Burma). Khin Win, Tin Kyi, and Trillion Hmun.

Union Burma J Life Sci. 2 (1): 11-15. ilus. 1969. Identifiers: Burma, Condition, Gyogon, Paddy-M, pH, Soils, Under, Waterlogged.

A study on changes of pH values of Gyogon paddy growing soil for 3 yr showed a steady rise of pH from 4.26-4.98 and 5.45 to 6.26. pH values increased with duration of submergence; it reached peak values at 120 days and declined on non-sub-mergence.--Copyright 1971, Biological Abstracts, W72-01204

FLOODPLAIN SOILS AT THE CENTER OF THE RUSSIAN PLAIN,

G. V. Dobrovol'skii.

Moscow Univ. 1968. 296 p. Identifiers: Book, Center, Floodplain, Plain, Rus-

A detailed description is given of the conditions of formation and the properties of soils along the Upper and the Middle Volga, in the floodplains of the rivers Klyazma, Moskva (including their forest zones), Oka and other rivers and afforested floodplains. The genesis and agricultural utilization of floodplain soils in the forest zone and the evolution and geography of floodplain soils are also described .- Copyright 1971, Biological Abstracts, W72-01241

SOIL MOISTURE DETECTION WITH IMAG-

ING RADARS, Georgia Southern Coll., Statesboro. For primary bibliographic entry see Field 07B. W72-01242

For primary bibliographic entry see Field 04D. W72-01257

TREE GROWTH AND FOREST SOILS PROCEEDING OF THE 3RD NORTH AMERICAN FOREST SOILS CONFERENCE HELD AT NORTH CAROLINA STATE UNIVERSITY AT RALEIGH IN AUGUST 1968, Chester T. Youngberg, and Charles B. Davey. Oregon State University Press, Corvallis, 1971. 527

p. Pr. \$10.00. Identifiers: American, Book, Conference, Forest, Growth, North, North-Caroline, Proceedings Raleigh, Rd, Soils, Symposium, Tree, University.

This volume contains papers from the 3rd conference sponsored by the Soil Science Society of America, the Soil Science Society of Canada, the Canadian Institute of Forestry and the Society of American Foresters. These proceedings continue the series' purpose of gathering in one place cur-rent information on the several disciplines which help to make up forest soil science and thus bridge the communication gap which has existed between foresters and soil scientists. Emphasizing the North American Eastern Coast, this volume deals with tree growth and forest soils. Papers emphasize fer-tilization, noting tree nutrition and nutrient cycling. Several papers are devoted to progress in forest soil survey and its use in forest management. The emphasis on forest soil biology indicates its importance in the study of forest ecosystems. Also included are studies on soil chemistry, soil water rela-tions and site factors and their influence on tree growth and wood quality. The importance of the soil in hardwood management in relationship to species is also emphasized. The final paper demon-strates that soil, roots and foresters should make a and their authors will be indexed in BIORESEARCH INDEX.—Copyright 1971, Biological Abstracts, Inc.

SIMPLIFIED PROCEDURE FOR EVALUATING SOIL LIQUEFACTION POTENTIAL, California Univ., Berkeley, Dept. of Civil Engineer-

For primary bibliographic entry see Field 08B. W72-01419

DESERT SANDFLOW BASINS AND A MODEL FOR THE DEVELOPMENT OF ERGS, Reading Univ. (England). Sedimentology Research Lab.

I. G. Wilson. Geographical Journal, Vol 137, No 2, p 180-199, July 1971. 8 fig, 1 tab, 12 ref.

Descriptors: \*Sands, \*Geomorphology, \*Wind velocity, \*Flow characteristics, \*Arid lands, velocity, \*Flow characteristics, \*Arid lands, Deserts, Beaches, Particle size, Dunes, Basins, Sediments, Weathering, Wind erosion, Estimating equations, Mapping, Deposition (Sediments), Flow

Identifiers: \*Sahara Desert, \*Sandflow

Loose sand is blown about deserts by wind. Potential sand flow rate ia a nonlinear function of sand grain diameter and wind shear velocity, and its magnitude can be found by vectorial addition. Sandflow resultants may be calculated from formulae using either wind velocity data or sandstorm records or estimated from bedform data. Sandflow maps are presented for 3 Saharan locales and for the entire Sahara. There are innumerable possible the entire sanara. There are innumerable possible sandflow resultants referring to a particular point. Each one is specific to a different combination of grain size, given time interval and mean sampling area around the point. Although sandflow maps are closely analogous to water drainage maps, they differ in that there is little direct relation between sandflow and topography. Deflation and deposition rates are discussed and it is suggested that long-term deflation by wind can only take place if there is a steady replacement of material, which usually occurs only on beaches where there are rivers. A general formula is developed for calculating actual ndflow rate, given a complete sandflow and deflation rate map of the region, and this is used to develop a model for predicting where and how ergs (areas of sand deposits) will form in a desert. Since erg development is strongly affected by the universal occurence of bedforms and their associated secondary flow systems, the ergs are rarely in equilibrium with their present mean sandflow systems. Also, surprisingly, deposition may occur in areas of unsaturated sand flow and where mean winds are accelerating and diverging. (Casey-Arizona) W72-01448

DETERMINATION OF HYDRAULIC CONDUC-TIVITY--CAPILLARY PRESSURE RELATION SHIP FROM SATURATION-CAPILLARY PRESSURE DATA FROM SOILS,

Utah Water Research Lab., Logar R. W. Jeppson.

Utah Water Research Laboratory, PRWG-59c-4, July 1970. 20 p, 2 tab, 1 fig, 11 equations, 6 ref.

Descriptors: \*Hydraulic conductivity, \*Capillary action, \*Permeability, \*Computer programs, \*Numerical analysis, Equations, Saturation, Evaluation, Mositure content.

Identifiers: \*Burdine Theory, Lagrange's interpolation formula

Burdine theory for obtaining hydraulic conductivity capillary pressure relationships was investigated The theory, which includes approximated integrals, gives accurate permeability values from pressure saturation data. A FORTRAN IV computer program evaluates the integrals numerically, using agrange's interpolation formula. Output obtained by the program is presented. The Burdine theory equation is Kr equals K divided by Ko, equals Se squared times the definite integral from S to Sr of p to the minus 2, divided by the definite integral from 1 to Sr of p to the minus 2. The formula is defined where Kr is relative intrinsic permeability, K is intrinsic permeability, Ko is saturated intrinsic permeability, p is pressure head, Se is effective saturation, Sr is residual saturation. (Popkin-

FORMULATION AND SOLUTION OF TRANSIENT FLOW OF WATER FROM AN IN-FILTROMETER USING THE KIRCHHOFF TRANSFORMATION,

Utah Water Research Lab., Logan.

R. W. Jeppson.

Utah Water Research Laboratory PRWG-59c-3, July 1970. 12 p, 1 tab, 1 fig, 20 equations, 1 ref.

Descriptors: \*Numerical analysis, \*Unsaturated flow, \*Porous media, \*Infiltration, \*Model studies, Equations, Darcy's Law, Boundaries (Surfaces), Computer programs, Flow characteristics.

Identifiers: Axisymmetric flow, Kirchhoff transfor-

A numerical solution, developed by the alternating direction implicit method, of the Darcian based differential equation for axisymmetric flow in partially saturated porous media is derived. Boundary and initial conditions are presented which describe the infiltration problem by Kirchhoff transformation. A computer solution output is presented. The paper is an extension of earlier work which seeks to numerically solve complex analytical flow problems in porous media. (Popkin-Arizona) W72-01456

DIVISION OF PLANT SOIL AND WATER SCIENCE.

Nevada Univ., Reno. Div. of Plant Soil and Water Science. For primary bibliographic entry see Field 03F. W72-01465

A THEORETICAL STUDY OF INFILTRATION INTO RANGE AND FOREST SOILS,

Utah Water Research Lab., Logan. J. E. Fletcher, and Y. Z. El-Shafei.

Utah Water Research Laboratory, PRWG60-1, 37 p., July 1970. 26 fig. 2 tab, 37 equations, 1 computer program, 18 ref.

Descriptors: \*Theoretical analysis, \*Infiltration, \*Capillary action, \*Darcy's Law, \*Porous media, Soil physical properties, Retention, Hydraulic gradient, Water supply, Hydraulic conductivity, Forest soils, Simulated rainfall, Flooding, Moisture content, Computer programs, Model studies, Numerical analysis, Equations.

Theoretical studies were undertaken to develop an extension of capillary flow theory and Darcian porous media flow theory. Such extension was initiated to find relationships between infiltration, soil physical properties and watershed retention; gradient, water supply and conduction factors were considered. Mass infiltration was computed for undisturbed field soils, and more than 400 rainfall simulator experiments were examined. Three theoretical equations were tested: Green and Ampt modified equation, Fletcher equation, and Fok and Hansen equation. The Fletcher equation being applicable only to 'denuded' watershed was less satisfactory than the others. Darcian equation were developed for surface flooding under any art tecedent moisture content. (Popkin-Arizona) W72-01469

SOIL AND WATER,

FEB 2 4 1972 For primary bibliographic entry see Field 03F. W72-01471

PACIFIC PUWER & LIGHT

THE EFFECT OF SPRINKLING INTENSITY AND SOIL TYPE ON OXYGEN FLUX DURING IRRIGATION AND DRAINAGE, Hebrew Univ., Rehovoth (Israel). Dept. of Irriga-

B. Gornat, H. Enoch, and D. Goldberg. Soil Science Society of America Proceedings, Vol 35, No 5, p 668-670, September-October 1971. 4 fig, 1 tab, 9 ref.

Descriptors: \*Irrigation effects, \*Sprinkler irriga-tion, \*Oxygen, \*Soil gases, Drainage effects, Soil chemistry, Aeration, Diffusion, Soil chemistry, Soil environment, Instrumentation, Infiltration, Soil water movement.

Identifiers: Soil oxygen flux, Soil aeration.

The effect of sprinkling intensity on oxygen flux in sand, loam, and clay soil was measured with platinum electrodes. From the beginning of irrigation until the wetting front reached the electrode, the reduction current was unrelated to oxygen flux and the measurements were meaningless. When the wetting front reached the electrode, high values were recorded. From then on, the oxygen flux decreased to a minimum value by the end of the irrigation. Shortly after irrigation and until drainage had almost ceased, flux increased to a new peak. Finally, the reduction current decreased although the real oxygen diffusion presumably increase Oxygen flux was higher at the low irrigation intensity because of a lower soil moisture content during infiltration at this rate. Aggregate breakdown and crust formation on the soil surface due to the high irrigation intensity inhibit gas exchange. (Knapp-USGS) W72-01525

#### Group 2G-Water in Soils

INFILTRATION FROM A TRICKLE SOURCE: I. MATHEMATICAL MODELS, Weizmann Inst. of Science, Rehovoth (Israel).

Dept. of Applied Mathematics.

A. Brandt, E. Bresler, N. Diner, I. Ben-Asher, and J. Heller.

Soil Science Society of America Proceedings, Vol 35, No 5, p 675-682, September-October 1971. 5 fig. 14 ref, append.

Descriptors: \*Infiltration, \*Mathematical models, \*Irrigation effects, \*Irrigation systems, Unsteady flow, Unsaturated flow, Soil water movement, Duf-fusion, Hydraulic conductivity. Identifiers: Trickle irrigation

Theoretical considerations were used to develop mathematical tools to analyze multidimensional transient infiltration from a trickle source. Two mathematical models considered are a plane flow model and a cylindrical flow model. The diffusion type water flow equation in unsaturated soil was solved numerically by an approach that combines the noniterative ADI difference procedure with Newton's iterative method. The method is reliable and can be used with confidence. Typical results demonstrate the effects of trickle discharge on the water content field, the saturated water entry zone, and the water flux at the soil surface. (See also W72-01527) (Knapp-USGS) W72-01526

### INFILTRATION FROM A TRICKLE SOURCE: II. EXPERIMENTAL DATA AND THEORETI-

Volcani Inst. of Agricultural Research, Bet-Dagan (Israel).

E. Bresler, J. Heller, N. Diner, I. Ben-Asher, and A. Brandt.

Soil Science Society of American Proceedings, Vol 35, No 5, p 683-689, September-October 1971. 8 fig, 9 ref.

Descriptors: \*Infiltration, \*Mathematical models, \*Irrigation effects, \*Irrigation systems, Unsteady flow, Unsaturated flow, Soil water movement, Diffusion. Hydraulic conductivity. Identifiers: Trickle irrigation

The theory of transient infiltration from a trickle source was compared with experimental results. The agreement between theory and experiment is generally good and suggests that the theory is applicable to many field situations. The theory, as well as the experimental data, indicate that for the conditions studied, an increase in the trickle discharge rate results in an increase in the horizontal wetted area and a decrease in the soil wetted depth. Hysteresis becomes more prominent when the trickle discharge is small, whereas, lack of precision in estimating the soil-water parameters is more crucial when the discharge is large. (See also W72-01526) (Knapp-USGS) W72-01527

#### STEADY INFILTRATION FROM SOURCES, CAVITIES, AND BASINS, Johns Hopkins Univ., Baltimore, Md. FROM POINT

Soil Science Society of America Proceedings, Vol 35, No 5, p 689-694, September-October 1971. 3 fig. 17 ref.

Descriptors: \*Infiltration. \*Soil water movement. \*Unsaturated flow, \*Saturated flow, \*Irrigation effects, Irrigation systems, Mathematical studies, Hydraulic conductivity, Diffusion. Identifiers: \*Trickle irrigation.

Steady infiltration from buried point sources and surface point sources is analyzed using partial differential equations for the matric flux potential and the Stokes' stream function associated with axially symmetric flows. Hydraulic conductivity is assumed to be an exponential function of the pressure head. Explicit expressions were obtained for the matric flux potential, the Stokes' stream function, the flux, the pressure head, and the total head. Related upward flows for which the soil becomes saturated everywhere are discussed briefly. Comparison of the solutions for buried point sources, surface point sources, and gravity-free flows shows how the gravitational force and the geometry insolutions are of interest in planning systems of trickle irrigation. (Knapp-USGS) W72-01528 teract in determining the nature of the flows. The

#### THE HYDRAULIC CONDUCTIVITY-WATER CONTENT RELATIONSHIP DURING NON-STEADY FLOW THROUGH A SAND COLUMN, Agricultural Research Service, Gainesville, Fla.

Soil and Water Conservation Research Div. J. S. Robers, and A. Klute.

Soil Science Society of America Proceedings, Vol 35, No 5, p 695-700, September-October 1971. 9 fig, 3 tab, 16 ref.

Descriptors: \*Hydraulic conductivity, \*Unsteady flow, \*Soil water movement, \*Unsaturated flow, Porous media, Drainage, Infiltration, Hydraulic

Water contents and hydraulic heads measured for three rates of draining and rewetting a vertical column of sand were used in Darcy's Law to determine hydraulic conductivity. The hydraulic conductivity was a single valued function of the water content, and exhibited no hysteresis. There was no relationship between hydraulic conductivity and the rate of change of water content, although the water content-pressure head relationship was rate dependent. (Knapp-USGS) W72-01529

#### RELATIONS BETWEEN SOIL MORPHOLOGY AND WATER-TABLE LEVELS ON A DIS-SECTED NORTH CAROLINA COASTAL PLAIN SURFACE.

Soil Conservation Service, Raleigh, N. C R. B. Daniels, E. E. Gamble, and L. A. Nelson. Soil Science Society of America Proceedings, Vol 35, No 5, p 781-784, September-October 1971. 5 fig. 1 tab, 7 ref.

Descriptors: \*Geomorphology, \*Coastal plains, \*Atlantic Coastal Plain, \*Water table, \*Soil types, Soil formation, Erosion, Sedimentation, Stratigraphy, Infiltration, Soil water movement, Groundwater movement. Identifiers: Typic Paleudults, Soil morphology.

Depth to water table in Typic Paleudults decreases away from the dissected edge of the geomorphic surface in east central North Carolina. This relation is linear in log form and statistically highly signifi-cant for 19 of 22 time periods tested. The greatest changes in water-table depths and soil morphology are within the first 0.15 to 0.3 km from the surface edge. Deep water tables are associated with thick A2 horizons and fine-textured B horizons. The shallow water tables are associated with thin A2 horizons, low-contrast mottling, and presence of Be bodies. This close association between water-table depths and soil morphology shows that landscape dissection, acting through its influence on water-table depths, is one of the driving forces in genesis of North Carolina Coastal Plain soils. (Knapp-W72-01532

#### HYDRAULIC PROPERTIES OF AN ORSTEIN

HORIZON, Georgia Univ., Athens, School of Forest Resources.

J. L. Lambert, and F. D. Hole. Soil Science Society of America Proceedings, Vol 35, No 5, p 785-787, September-October 1971. 1 fig, 2 tab, 7 ref.

Descriptors: \*Hydraulic conductivity, \*Soil water movement, \*Glacial drift, \*Wisconsin, Capillary conductivity, Aquicludes, Soil types, Compacted soils, Glacial soils, Soil profiles.

Identifiers: Ortsteins, Spodosols, Typic Haplorthods.

An ortstein horizon was encountered in a soil profile identified as a Wallace loamy sand on the glacial outwash plains of central Wisconsin. The horizon is distinguished by its color, strength properties, free iron concentrations, and bulk density. The horizon is more permeable than the profile above it during wet conditions, and it is less perme-able than adjacent horizons when the soil dries out. Water retention of this ortstein horizon is greater than that of the rest of the profile by as much as 40%. The greatest differences in hydraulic properties are associated with the layer of maximum bulk density, while the maximum iron concentrations occur at a slightly lesser depth. (Knapp-USGS) W72-01533

# MOVEMENT AND PERSISTENCE OF DIEL-DRIN AND LINDANE IN SOIL AS IN-FLUENCED BY PLACEMENT AND IRRIGA-

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Agricultural Research Service, Riverside, Calif. Soil and Water Conservation Research Div For primary bibliographic entry see Field 05B. W72-01534

### MICRORELIEF, SOIL WATER REGIME, AND LOBLOLLY PINE GROWTH ON A WET,

MOUNDED SITE,
Forest Service (USDA), Pineville, La. Southern
Forest Experiment Station.

For primary bibliographic entry see Field 021. W72-01535

#### SPATIAL VARIABILITY OF UNSATURATED HYDRAULIC CONDUCTIVITY,

Arizona Univ., Tucson J. G. Stockton, and A. W. Warrick. Soil Science Society of America Proceedings, Vol 35, No 5, p 847-848, September-October 1971. 2 fig. 7 ref.

Descriptors: \*Hydraulic conductivity, \*Unsaturated flow, \*Variability, Soil water movement, Pressure head.

Spatial variability of unsaturated hydraulic conductivity was studied in Pima Clay loam. Calculations of hydraulic conductivity were based on the moisture release data using a modified Millington-Quirk equation. One standard deviation to either side of the average moisture release curve represented a 20 to 30% variation in the unsaturated hydraulic conductivity. This offers a relatively quick and easy method for estimating variability of unsaturated hydraulic conductivity variation from pressure head vs. moisture relations. Input needed for application is the moisture release rela-tions and their variances. (Knapp-USGS) W72-01540

# EFFECT OF SOIL MOISTURE TENSION ON NITRATE ACCUMULATION IN DRUMMER SILTY CLAY LOAM, Illinois Univ., Urbana. Dept. of Agronomy.

B. R. Sabey, and D. D. Johnson.

Soil Science Society of America Proceedings, Vol 35, No 5, p 848-850, September-October 1971. 2 fig, 1 tab, 2 ref.

Descriptors: \*Nitrates, \*Soil moisture, \*Moisture tension, Soil chemistry, Loam, Nitrification.

In the Drummer silty clay loam, the rates of NO3 accumulation were 63 to 14% as great at soil moisture tensions of 1/3 to 15 bar, as between 1/20 and 1/10 bar. At all tensions except 15 bar the mean relative rates of NO3 accumulation are slightly lower for the silty clay loam than for silt loams. (Knapp-USGS) W72-01541

THE DETERMINATION OF MERCURY IN SOILS BY FLAMELESS ATOMIC ABSORP-TION.

Texas A and M Univ., College Station. Dept. of Agricultural Analytical Services. For primary bibliographic entry see Field 05A. W72-01542

ON-SITE INVESTIGATIONS OF INFILTRA-TION (NATURNYYE ISSLEDOVANIYA FIL'-TRATSII),

V. I. Aravin, and O. N. Nosova. Izdatel'stvo 'Energiya', Leningrad, 1969. 256 p.

Descriptors: \*Groundwater, \*Groundwater movement, \*Infiltration, \*On-site investigations, \*Hydraulic structures, Earth dams, Dam foundations, Deformation, Failures, Dam failure, Hydraulic conductivity, Permeability, Transmissivity, Soil mechanics, Porous media, Drainage, Saturated flow, Unsaturated flow, Water yield, Piezometers. Identifiers: \*USSR, Infiltration rates.

This monograph consisting of 9 chapters examines the theoretical principles applicable to field investigations of groundwater infiltration. Studies of infiltration phenomena were conducted in the course of planning the construction and operation of hydraulic structures, including their foundations, for areas in which the natural groundwater regime would be disturbed. The role of infiltration in hydraulic structure failures was examined in terms of the harmful effects of infiltration on these structures. The text material is intended as an aid to hydraulic engineers, construction engineers, and hydrogeologists engaged in a study of groundwater hydrodynamics. (Josefson-USGS) W72-01552

SOIL MOISTURE AND TEMPERATURE MEA-SUREMENTS IN THE FOREST OF VALLOM-BROSA, FIRENZE METHODOLOGICAL RE-PORT, G. Sanesi, and M. Sulli.

Inform Bot Ital. 2 (2): 1970. 62-71.

Identifiers: Firenze, Forest, Growth, Instrumentation, Italy, Measurements, Methodological, Moisture, Plant, Soil, Temperature, Vallombrosa.

MEASUREMENT OF SOIL MOISTURE FLUC-TUATION IN A SAGEBRUSH-D GRASS-M COMMUNITY.

P. W. Jacoby, Jr.

J Colo Wyo Acad Sci. 7 (1): 1970. 32-33. Identifiers: Community, Fluctuation, Grass-M, Measurement, Moisture, Sagebrush-D, Soil, Vegetation. W72-01613

MEASUREMENTS OF SURFACE DRAINAGE IN A VINEYARD SOIL WITH A STONY SUB-SOIL UNDER DIFFERENT TYPE OF CULTIVA-

B. Steinberg, and M. Weber.

Wein-Wissenschaft. 26 (3/4): 1971. 135-145. Identifiers: Cultivation, Drainage, Grape-D, Limestone, Measurements, Soil, Stony, Subsoil, Surface, Vineyard. W72-01618

CHANGE IN SOIL MOISTURE CONTENT FROM THE SURFACE TO THE GROUND WATER LEVEL IN THE SOUTHERN STEPPE OF THE UKRAINE.

K. G. Seleznev

Sov Soil Sci (Transl Pochvoved). 2 (5): 1970. 634. Identifiers: Ground, Moisture, Regime, Soil, Southern, Steppe, Surface, Ukraine, USSR.

INFLUENCE OF FILM COVERING ON THE THERMO PHYSICAL CHARACTERISTICS OF THE UPPER SOIL LAYER,

A. V. Rashkin, N. G. Shuvalov, and Y. M. Vedyayev.

Sov Soil Sci (Transl Pochvoved). 2 (5): 1970. 634-635.

Identifiers: Conductivity, Covering, Diffusivity, Ethylene, Film, Layer, Physical, Poly, Soil, Ther-mal, Thermo, Upper, USSR. W72-01627

PROSPECTS FOR THE ORGANIZATION OF SOIL IRRIGATION ON THE BASIS OF LOCAL RUNOFF IN THE KALMYK-ASSR,

A. A. Popov, and M. Y. Petrenko. Sov Soil Sci (Transl Pochvoved). 2 (5): 1970. 636. Identifiers: Irrigation, Kalmyk-Assr, Local, Organization, Reclamation, Runoff, Salinization, Soil, Solonetsization, USSR.

SEASONAL FREEZING AND ITS EFFECT ON THE GENESIS AND FERTILITY OF SIBERIAN SOILS.

N. V. Orlovskiy.

Sov Soil (Transl Pochvoved). 2 (5): 1970. 637. Identifiers: Fertility, Freezing, Genesis, Nutrient, Permafrost, Regime, Salt, Seasonal, Siberian, Soils, USSR W72-01629

IMPROVEMENT OF SALINE SOILS IN THE FLOOD-PLAINS AND DELTAS OF RIVERS IN THE WESTERN PART OF THE BLACK SEA LOWLAND,

L. G. Pekatoros.

Sov Soil Sci (Transl Pochvoved). 2 (5): 1970. 638. Identifiers: Black, Deltas, Depth, Discharge, Flood-plains, Ground, Lowland, Rivers, Saline, Sea, Soils, USSR, Western. W72-01630

#### 2H. Lakes

CARBONATE EQUILIBRIA IN LAKE ERIE, State Univ. (Coll.), Fredonia, N.Y. For primary bibliographic entry see Field 05B. W72-01111

POLLUTION POTENTIAL OF SOME NEW HAMPSHIRE LAKES,
Dartmouth Coll., N.H. Dept. of Earth Sciences.

For primary bibliographic entry see Field 05B. W72-01131

LIMNOLOGICAL INVESTIGATIONS PALMER STATION. Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology. G. L. Samsel, and E. B. Wodehouse. Antarctic Journal U.S., Vol 6, No 4, p 95-96, July-August 1971.

Descriptors: \*Eutrophication, \*Lakes, \*Limnolo-Descriptors: "Eutrophication," Laws, "Liminos, g, "Antarctic, Nutrients, Water pollution sources, Phosphates, Nitrates, Organic matter, Water chemistry, Water quality, Identifiers: "Penguins, Nutrient sources.

During the austral summer of 1970-1971, several meltwater lakes and ponds in the vicinity of Palmer Station, Anvers Island, Antarctica were studied to determine the effect of limiting nutrient factors upon algal productivity. Two lakes were chosen for having strikingly different trophic states. The larger and deeper of the two was behind the old British and U.S. bases at Norsel Point. The smaller and shallower lake was on nearby Humble Island. About 0.6 km apart, the lakes were similar except for nutrient concentrations; chloride, ammonium, and phosphate were many times higher in the Humble Island lake than in the Norsel Point lake. An Adelie penguin rookery 100 m from the Humble Island lake was the cause of the nutrient enrichment of that lake. Total acetone-extractable chlorophyll and rate of carbon fixation indicated that productivity rates were many times higher in the eutrophic Humble Island lake than in the oligotrophic Norsel Point lake. Of the several chemical nutrients tested only phosphate and am-monium stimulated algal productivity in the Norsel Point lake's laboratory microecosystem. Ammoni-um proved to be the nutrient in critical supply, insing productivity threefold when the laboratory ecosystem was increased from Norsel Point lake to Humble Island lake concentrations. (Knapp-LISCIST W72-01152

RELIEF AND HYDROGEOLOGICAL CONDI-TIONS OF THE LOP NOR LACUSTRINE PLAIN (REL'YEF I GIDROGEOLOGICHESKIYE USLOVIYA OZERNOY RAVNINY LOBNORA), Ye. I. Selivanov.

Ye. i. Senvanov. Zevestiya Vsesoyuznogo Geograficheskogo Obshchestva, Vol 102, No 1, p 23-33, January-February 1970. 4 fig, 1 tab, 10 ref. Geograficheskogo

Descriptors: \*Lakes, \*Lake basins, \*Lake morphology, "Hydrogeology, "Topography, Geomorphology, Groundwater, Water levels, Water chemistry, Wind erosion. Identifiers: "USSR, "China, Sinkiang Province,"

Lop Nor, Lacustrine deposits, Lowlands, Plains, Deflation basins.

Lake Lop Nor, located at the east end of the Tarim basin in Sinkiang Province, West China, is unusual in that it belongs to the class of wandering or, more precisely, periodically regenerating lakes. This is the result of (1) the specific hydrogeological and hydrological conditions of the lacustrine plain and (2) the climatic characteristics of the river basin area. Lake Lop Nor is at present fed by a single river, the Konche-Dar'ya, which originates in Lake Bagrash-Kul'. The location of the lake depends upon which part of the lowland is filled with the waters of the Tarim and Konche-Dar'ya Rivers, which wander across the plain in their reaches. To determine the cause of this wandering, the ancient history of the lake must be studied. Without taking the relief-forming processes in the Lop Nor lowland into account, it will be difficult to solve the problem of reclaiming neighboring areas where oases are concentrated. Given the presence of numerous deflation basins in the lowland, the following inference may be drawn: any increase in the groundwater level will lead, as in the past, to the formation of lakes in these basins; conversely, any decrease in groundwater level will result in the disappearance of these lakes. (Josefson-USGS) W72-01160

LONG-PERIOD WATER REGIME OF LAKE KHANKA (MNOGOLETNIY VODNYY REZHIM OZERA KHANKA),

V. P. Nekhaychik. Usvestiya Vsesoyuznogo Geograficheskogo Obshchestva, Vol 102, No 1, p 49-53, January-February 1970. 2 fig, 2 tab, 7 ref.

Descriptors: \*Lakes, \*Water level fluctuations, Water levels, Discharge (Water), Water balance, Precipitation (Atmospheric), Evaporation, Drainage.

Identifiers: \*USSR, Maritime Territory, Lake Khanka, Amur River, Khabarovsk, Water regime.

The cyclic water-level fluctuations of Lake Khanka (Maritime Territory) for the period 1868-1966 were examined to describe the long-period water regime of poorly drained lakes. A total of 4 dry and 4 wet phases, lasting an average of 13 and 12 years respectively, were observed in the Lake Khanka region along with periods of several years duration with low- and high-water levels in the lake. The water regime of Lake Khanka is determined by the hydrometeorological and hydrodynamic conditions

#### Group 2H-Lakes

in the lake basin. The drainage of the lake decreases markedly in low-water years, at which time the lake resembles a drainless lake. When the water level is high, the drainage of the lake in-creases sharply. (Josefson-USGS) W72-01161

COMPUTATION OF SUBSURFACE FLOW COMPUTATION OF SUBSURFACE FLOW FROM LAKE BOL'SHOY ALAGEL' BY THE WATER-BALANCE METHOD (RASCHET POD-ZEMNOGO STOKA IZ OZERA BOL'SHOY ALAGEL' METODOM VODNOGO BALANSA), Kh. D. Zamanov.

Izvestiya Vsesoyuznogo Geograficheskogo Obshchestva, Vol 102, No 1, p 75-79, January-February 1970. 2 fig, 1 tab, 12 ref.

Descriptors: \*Subsurface flow, \*Subsurface runoff, \*Water balance, Runoff, Runoff coefficient, Rainfall-runoff relationships, Precipitation (Atmospheric), Evaporation, Water chemistry, Water analysis, Orography, Climatic data, Hydrologic data.

Identifiers: \*USSR, Lesser Caucasus, Azerbaydzhan, Lake Bol'shoy Alagel', Mountain lakes, Mineralization.

Lake Bol'shoy Alagel', located in the alpine zone of the Lesser Caucasus near the Armenian border, is the largest and most typical of the mountain lakes of Azerbaydzhan. The lake is located at an elevation of 2,729 m and has an area of 510 hectares. The long-term average water balance of the lake is as follows: (1) inflow of surface waters into the lake-95.8% or 98.68 million cu m/year; (2) atmospheric precipitation over the lake-4.2% 4.34 million cu m/year; (3) subsurface outflow from the lake--98.5% or 101.49 million cu m/year; and (4) evaporation from the water surface--1.5% or 1.53 million cu m/year. The runoff coefficient for the area is about 0.90-0.95. (Josefson-USGS) W72-01162

#### ECOLOGY OF DAPHNIA IN BULL SHOALS RESERVOIR,

South Dakota Cooperative Fishery Unit.,

Brookings. Richard L. Applegate, and James W. Mullan. US Fish Wildl Serv Res Rep. 74. 1-23. Illus. Maps.

Identifiers: Bosmina-Longirostris, Bull-Shoals, Daphnia, Daphnia-Ambigua, Daphnia-Galeata, Daphnia-Parvula, Daphnia-Retrocurva, Daphnia-Schodleri, Dorosoma-Petenense, Ecology, Leptodora-Kindtii, Reservoir.

Life histories of Daphnia galeata mendotae, D. retrocurva, D. parvula, D. ambigua, and D. schodleri are compared with year class strength and food of threadfin shad, Dorosoma pretenense, in Bull Shoals Reservoir from 1965 to 1967. Maximum population density of daphnids was in April, May, and June. Populations declined to insignifi-cant densities throughout the rest of the year. Declines coincided with inclusion of Daphnia in the diets of A 14.0-mm threadfin shad. Declines in the summer of 1967 coincided with both young shad predation and high Leptodora kindtii density. Population changes associated with declining year class strength of threadfin shad were an increase of the large D. schodleri and L. kindtii from nondetectable or trace densities to relatively large populations, an increase from nondetectable densities of daphnids in the summer to detectable densities, a twofold to threefold increase in the summer standing crops of Bosmina longirostris.--Copyright 1971, Biological Abstracts, Inc. W72-01200

#### HYDROBIOLOGICAL WORK OF THE VOLTA BASIN RESEARCH PROJECT 1963-196

G. W. Lawson, T. Petr, S. Biswas, E. R. I. Biswas, and J. D. Reynolds.

Bull Inst Fondam Afr Noire Ser A Sci Natur. 31 (3): 965-1003. Illus 1969.

Identifiers: Africa, Basin, Hydrobiological, Phyto, Plankton, Project, Volta, West, Zoo.

Zooplankton and phytoplankton of the lake during the period 1963-1968 are characterized.—Copy-right 1971, Biological Abstracts, Inc. right 1971, E W72-01213

# THE INVERTEBRATE ZOOBENTHOS OF LAKE TIBERIAS. II. QUANTITATIVE DATA (LEVEL BOTTOMS), Hebrew Univ., Jerusalem (Israel). Dept. of Zoolo-

F. D. Por, and G. Eitan. isr J Zool. 19 (2): 125-134. Illus. Maps. 1970. Identifiers: Benthos, Biomass, Bottoms, Invertebrate, Israel, Lake, Nematodes, Oligochaetes, Quantitative, Tiberias, Zoo.

Lake Tiberias is a warm monomictic lake. Anaero-bic conditions in the hypolimnion (below 15-25 m) appear shortly after stagnation sets in, and last 8-9 mo. out of 12. The lake bottom can be separated mo. out of 12. The lake bottom can be separated into 4 faunistic belts: littoral, sublittoral, epiprofundal and profundal. The epiprofundal (15-25 m) is least populated both qualitatively and quantitatively. The biomass in the sublittoral reaches a maximum 7.6 g/sq m out of which 4.2 g are oligochaetes and 2.8 g nematods. In the profundal the maximum value found is 3.6 g/sq m out of which 3.4 g are nematods and 0.2 oligochaetes. The biomass calculated as an average for the whole lake bottom (without molluscs) in 8.5 kg/ha.--Copyright 1971, Biological Abstracts, Inc. W72-01217

# CARBONATE DEPOSITION ON THE RIVER FLOODPLAINS OF THE WOOD BAY FORMATION (DEVONIAN) OF SPITSBERGEN, P. F. Friend, and M. Moody-Stuart. Geol Mag. 107 (3): 181-195 Illus Maps 1970.

Identifiers: Arctic, Bay, Carbonate, Charophyte, Deposition, Devonian, Floodplains, Formation, River, Spitsbergen, Svalbard, Wood.

The argillaceous siltstones of the floodplains con tain, on average, 15% of calcium carbonate. This appears to have been precipitated between the detrital grains shortly after their deposition. The siltstones also contain calcium carbonate concretions which formed as the ground water dried out in the upper part of the water table. Bedded maristones, containing up to 68% of carbonate, accumulated in lakes on the floodplains. Precipitation mulated in lakes on the Hoodplains. Precipitation of carbonate in the lakes appears to have been stimulated by Charophyte algae. The marlstones include dolomite in some parts of the Formation. The channel-fill deposits include carbonate detritus from the source areas, and from reworking of Wood Bay Formation sediments. They are frequently cemented by calcite. The regional pattern of carbonate derivation, transportation and deposition is summarized.—Copyright 1971, Biological Abstracts, Inc. W72-01239

#### THE DYNAMICS OF THE POPULATION SIZE OF THE LAKE SEVAN KHRAMULYA WITH LOWERING OF THE LEVEL OF THE LAKE,

(IN RUSSIAN),
For primary bibliographic entry see Field 04A.
W72-01253

#### CONTROL OF CHIRONOMID MIDGES IN RECREATIONAL LAKES,

California Univ., Riverside. Dept. of Entomology. For primary bibliographic entry see Field 05G. W72-01267

#### THE KOKANEE SALMON IN LAKE TAHOE,

Dep. Fish Game, Sacramento, Calif. California State Dept. of Fish, and Game, Sacramento. Almo J. Cordone, Stephen J. Nicola, Philip H. Baker, and Ted C. Frantz. Calif Fish Game. 57 (1): 28-43. Illus. Maps. 1971. Identifiers: Cladoceran, Diet, Distribution, Kokanee, Lake, Oncorhynchus-Nerka, Populations, Salmon, Stocking, Tahoe.

Large numbers of kokanee salmon, Oncorhynchus nerka, fry were stocked in Lake Tahoe from 1949 through 1955. Kokanee became established but the population remained at a low level until 1963 when a dramatic increase in the number of spawners was observed. A fishery finally developed in 1967. Major spawning concentrations occur in Taylor Creek and along the shores of McKinney Bay. In most years from 1960 through 1968 virtually the entire Taylor Creek; run was composed of a single most years from 1960 through 1968 virtually the entire Taylor Creek run was composed of a single age group from certain strong year classes. Presence of strong year classes suggests high survival of naturally-spawned fish. There is some evidence, however, of high egg retention. Lake Tahoe kokanee grow rapidly and a trend toward increasing growth rates since 1961 is suggested. Their length-weight relationship was log W—3.26090 ... 2.91063 log L. Their diet consisted mostly of cladocerans. They are widely distributed in the limnetic zone and strongly surface oriented, except during the summer and early fall when large schools form off Taylor Creek at depths from 50 to schools form off Taylor Creek at depths from 50 to 120 ft.—Copyright 1971, Biological Abstracts, Inc. W72-01290

#### USE OF AN ECHOSOUNDER IN MEASURING DISTRIBUTION OF RESERVOIR FISHES

Bureau of Commercial Fisheries, South Central Reservoir Investigations.

James W. Mullan, and Richard L. Applegate. U S Bur Sport Fish Wildl Tech Pap. 19. 3-16. Illus.

Identifiers: Chaoborid, Distribution, Dorosoma, Echosounder, Fishes, Measuring, Movement, Populations, Reservoir.

A recording white-line depth sounder was used to study annual fish (Dorosoma) distribution in 2 deep reservoirs on the White River, Arkansas and Missouri. Varying seasonal activity levels of fish, attenuation of the sound beam at depths over 100 ft, and lack of precision in the identification of echo traces precluded rigorous interpretation of echograms. The inherent picture sense of echograms provided seasonal perspectives of fish dis-tribution with respect to diel movement, depth and basin location, limnetic concentrations, and O2 temperature conditions. Scattering layers as-sociated with planktonic chaoborid populations and suspected chemical constituents were dis-closed in one of the reservoirs undergoind initial.— Copyright 1971, Biological Abstracts, Inc. W72-01299

#### DYNAMICS OF ROTIFERA IN THE HERAS-TRAU, FLOREASCA AND TEI LAKES, (IN RU-MANIAN),

Academia R.S.R., Bucharest. Institutul de Biologie. S. Godeanu.

Stud Cercet Biol Ser Zool. 21 (3): 279-288. Illus. 1969. English summary. Identifiers: Dynamics, Floreasca, Herastrau, Lakes,

Nutrients, Phyto, Plankton, Romania, Rotifera, Tei, Temperature, Turbulence.

The phytoplankton, temperature, turbulence and organic nutrients are related to the rotatorian populations of the lakes.—Copyright 1971, Biological Abstracts, Inc. W72-01304

#### NORWEGIAN RECORDS CHAROPHYTES FROM FRESHWATER, WITH NOTES ON CHARA LAKES AND LIMESTONE AREAS, (IN NORWEGIAN),

Zoologisk Museum, Oslo (Norway).

Jan Okland.

Blyttia. 27 (2): 92-106. Ilus. 1969. English summa-

ry. Identifiers: Calcium, Chara, Charophytes, Fresh, Hardness, Lakes, Limestone, Norwegian, pH,

A description is made of dense stands of charophytes in a mountain lake, Helin, located 868 m above sea level (Vang in Oppland). Here the charophytes were present down to a depth of at

least 15 m, and at one station in the lake the quantileast 15 m, and at one station in the laake the quantity of macrovegetation had its optimum at 15 m. This possibly represents the deepest optimum for macrovegetation in Norwegian lakes. At 20 m, macrovegetation was not observed. In Helin the great quantity of macrovegetation in the deeper areas has a pronounced effect on the production of bottom fauna. About 1,300 sites were investigated, down to a depth of maximum 1.5 m. Of these sites 831 were lakes. In 34 lakes, 2 rivers, and 1 pond occurrences of charophytes were noted. A list of these 37 localities is presented together with observations of pH and total hardness (1 deg dH - 10 mg 'CaO'/l). In S.E. Norway, 542 lakes were investigated. For 533 of these lakes both pH and total hardness were measured. The 15 lakes with records of charophytes within this region all have a high or fairly high content of lime salts (10.7 to 2.6 deg dH), and 13 of these lakes were located in limestone areas with unaltered Cambro-Silurian rocks. The majority of these 15 lakes represent typical Chara lakes as described by Almquist. Although 80% of the investigated lakes had a total hardness value below 2 deg dH, no observations of charophytes are made in these lakes. In the remaining parts of Norway 287 lakes were investigated. se lakes did not have a particularly high content of lime salts. The importance of regional studies in the geological area of the Oslo Region is emphasized. The Ca content in the various lakes shows great variations, and the region covers an exceptionally wide range of lake types.—Copyright 1971, Biological Abstracts, Inc. W72-01306

FORMATION OF BOTTOM FAUNA IN THE OTKAZNOYE RESERVOIR FOR THE FIRST THREE YEARS OF ITS EXISTENCE, (IN RUS-

SIAN), T. D. Slepukhyna. Gidrobiol Zh. 6 (5): 15-19. Map. 1970. English summary.

Identifiers: Bottom, Cyclops-Vicinus, Existence, Fauna, Formation, Oligochaetes, Otkaznoye, Reservoir, St, USSR, Years.

The Otkaznove reservoir was constructed in 1965. The area of its water surface reaches 22 km sq and the maximal depth is approximately 18 m. Sixtytwo spp. and forms of benthic organisms were found. However the quantity and biomass of benthos were low. There are some peculiarities in the initial development of bottom fauna, viz: the absence of molluscans, the small density of oligochaete population and the summer appearance of great numbers of Cyclops vicinus in the benthos.--Copyright 1971, Biological Abstracts, Inc. W72-01307

THE SALSES-LEUCATE POND. ITS PRIN-CIPAL PHYSICOCHEMICAL CHARAC-TERISTICS AND THEIR VARIATIONS (IN 1955-1956 AND FROM 1960-1968),

P. Arnaud, and R. Raimbault. Rev Trav Inst Peches Mar. 23 (4): 355-444. 1969. Identifiers: Fishery, France, Mussel, Oyster, Physicochemical, Pond, Principal, Salinity, Salses-Leucate, Thermal, Variations.

Variations obtained in thermal and salinity measurements of the pond are principally the result of heavy rains. Proximity to continental marine waters also affect salinity of the area. The possibility of raising mussels and oysters in the pond is indicated.--Copyright 1971, Biological Abstracts, Inc. W72-01310

ACETYLENE REDUCTION (NITROGEN FIXA-TION) IN WISCONSIN LAKES, Wisconsin Univ., Madison. Water Resources

For primary bibliographic entry see Field 05C. W72-01324

THE LITTORAL MACROPHYTE VEGETA-TION OF LAKE WINGRA, Wisconsin Univ., Madison. Water Resources

S. A. Nichols, and S. Mori.
Reprint OWRR B-019-WIS, from Wisconsin Academy of Sciences, Arts and Letters, Vol 59, p 107-119, 1971. 4 fig, 1 tab, 15 ref. OWRR B-019-

Descriptors: \*Submerged plants, \*Aquatic weeds, \*Vegetation, Wisconsin, Lakes.

Identifiers: \*Myriophyllum spicatum, \*Line intercept, \*Depth, SCUBA apparatus, Sampling techniques, Lake Wingra, Dane County.

Over the past century the aquatic vegetation of Lake Wingra, Dane County, Wisconsin has changed from a vegetation type which was probably dominated by Vallisneria americans and Potamogeton spp. to one which is 68 percent Myriophyllum spicatum. M. spicatum is a European species that appears to be a very aggressive invader. The value of M. spicatum to the aquatic plant community is low. The time or mechanism of the invasion could not be precisely determine. To provide a basis for assessing the role of M. spicatum in the present community, and to provide a basis for continued studies on the lake the submerged aquatic plants were sampled by the line intercept method. Forty lines, approximately perpendicular to the shoreline and extending to the depth at which growth of submerged aquatic plants ceased, were sampled. All plants intercepting the line were recorded within consecutive 5 m segments of the line. Depth data, shore vegetation, and soils data were taken relative to the transect lines. For descriptive and mapping purposes the vegetation was divided into five communities. The data are summarized in map and tubular form. W72-01325

CONTINUATION OF STUDIES ON THE HYDROLOGY OF PONDS AND SMALL LAKES, Minnesota Agricultural Experiment Station, St.

E. R. Allred, P. W. Manson, G. M. Schwartz, P. Golany, and J. W. Reinke.

Available from the National Technical Information

Available Holm the National Technical Information Service as PB-204 543, \$3.00 in paper copy, \$0.95 in microfiche. Univ. of Minnesota, Agricultural Experiment Station, Tech. Bull. No 274, 1971. 62 p, 33 fig, 45 tab, 30 ref. B-002-Minn (4).

Descriptors: \*Ponds, \*Seepage, Precipitation, Evaporation, \*Lakes, Lake beds, Transpiration, Groundwater, Water budget, Ice, Mass transfer, Groundwater, Mater School, School, School, Rein gage, Recharge, Evaporation pans, Topography, Soil, Sediments, Chemical analysis, Computer programs, \*Minnesota, Groundwater

Identifiers: \*Distance thermograph, \*Water level recorders, Totalizing anemometer, Hygrothermo-

The study of the hydrology of small lakes and ponds in Minnesota started in 1962 as a project based on measuring the change in water and ice levels on 46 small bodies of water. The result of 3 years of study were published in 1968. Four of the 46 bodies of water were selected for more detailed studies. Water budgets were calculated by a computer program from field data collected by recording instruments. Evaporation and net seepage were calculated with the quasi-mass transfer equation. Average net seepage of the four bodies of water was 1.2 feet per year. The seepage rate accounts for about 12 to 20 percent of the total losses. It is concluded that the regimen of shallow bodies of water in Minnesota is controlled primarily by the ratio between precipitation and evaporation. The way to conserve water resources for groundwater supplies is to induce infiltration over the surface rather than to store water in open ponds where evaporation causes it to be lost to the atmosphere. (Walton-Minnesota) W72-01327 METHODOLOGY TO EVALUATE SOCIO--ECONOMIC BENEFITS OF URBAN WATER RESOURCES.

Berger (Louis) Inc., East Orange, N.Y. For primary bibliographic entry see Field 06B. W72-01343

A DESCRIPTION OF HUTCHINSON LAKE, ON-

Fisheries Research Board of Canada, Winnipeg (Manitoba). Freshwater Inst.

J. R. Vallentyne. Limnology and Oceanography, Vol 16, No 2, p 473-476, 1971. 1 fig. 2 tab, 2 ref.

Descriptors: \*Lakes, Bathymetry, Lake morphometry, Geomorphology, Physical proper-ties, Chemical properties, Biological properties,

Identifiers: \*Experimental Lakes Area (Ontario),
\*Hutchinson Lake (Ontario).

Lake 305 in the Experimental Lakes Area, northwestern Ontario (Canada) was named Hutchinson Lake in recognition of G Evelyn Hutchinson's contribution to limnology. It is the deepest and most oligotrophic of the 46 small lakes in the ELA and lies in the south-central part of the Canadian Precambrian Shield. Local geographic features, physical, chemical, and biological characteristics are given in detail. (Auen-Wisconsin) W72-01362

NITROGENASE ACTIVITY IN WISCONSIN LAKES OF DIFFERING DEGREES OF EUTROPHICATION, Wisconsin Univ., Madison. Water Resources

Center. For primary bibliographic entry see Field 05C. W72-01373

WATER RESOURCES DATA FOR TEXAS, 1970 PART 1. SURFACE WATER RECORDS. Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 07C. W72-01380

A SUPRAGLACIAL EXTENSION OF AN ICE-DAMMED LAKE, TUNSBERGDALSBREEN, Glasgow Univ. (Scotland). Dept. of Geography. For primary bibliographic entry see Field 02C. W72-01391

LAKES OF THE SEMIARID ZONE OF THE USSR (OZERA SEMIARIDNOY ZONY SSSR), Laboratory of Limnology, Leningrad (USSR).

Izdatel'stvo 'Nauka', Leningrad, Shnitnikov, A. V., ed, 1970. 304 p.

Descriptors: \*Limnology, \*Lakes, \*Lake basins, \*Lake morphometry, \*Lake morphology, Bodies of water, Ponds, Estuaries, Shores, Aquatic plants, Aquatic microbiology, Semiarid climates, Heat balance, Radiation, Water chemistry, Salinity, Water levels, Sediments, Groundwater, Variability. Identifiers: \*USSR, \*Kazakhstan, \*Water regime, \*Geobotany, Plant communities, Phytocoenoses, polarization. Saprophytes, Spon Mineralization, Steppes. Spontaneous

This collection of 15 papers is the second in a series of monographs devoted to a study of lakes in the semiarid zone of the USSR. Particular attention is paid to the secular variability of the water regime of lakes in Kazakhstan and to the study of ground-water in lake basins of the area. Various aspects of the physical chemical, and meteorological, and biological conditions in lakes are examined. These include: (1) morphometric parameters of lakes; (2) shoreline processes of lakes; (3) mineralization and ionic composition of lake and pond waters; (4) heat balance and radiation regime of lakes; (5) flora and plant associations of steppe lakes; (6)

#### Group 2H-Lakes

plant communities and marine overgrowth of ponds; and (7) transpiration from semiarid-zone estuarine vegetation. (See also W72-01404 thru W72-01413) (Josefson-USGS)

EFFECT OF SECULAR VARIABILITY OF A WATER REGIME OF DRAINAGE BASINS ON THE DEVELOPMENT OF LAKES (VLIYANIYE VNUTRIVEKOVOY IZMENCHIVOSTI UVLAZHNENNOSTI BASSEYNOV OZER NA

RAZVITIVE IKH DEPRESSLY), Laboratory Limnology, Leningrad (USSR). A. V. Shnitnikov.

In: Ozera semiaridnoy SSSR; Izdatel'stvo 'Nauka', Leningrad, p5-19, 1970. 11 fig, 3 tab, 15 ref.

Descriptors: \*Limnology, \*Lakes, \*Lake basins, \*Variability, \*Fluctuation, Water level fluctuations, Saline lakes, Saline water, Fresh water, Precipitation (Atmospheric), Air temperature, Semiarid climates, Bottom sediments, Vegetation,

Fish, Distribution patterns.

Identifiers: \*USSR, Asia, Kazakhstan, Ural Mountains, Water regime, Mineralization, Biotic

Basic patterns in the secular variability of lake basins in an area extending from the Ural Mountains and Ural River eastward to the Ob' River were examined in conjunction with the distribution of freshwater and saline lakes in Kazakhstan. Coefficients, which define the density of lakes in various geographic zones of Kazakhstan, were derived. The effect of secular variability of a water regime on mineralization and biotic processes was evaluated along with the physico-geographic and ecological consequences. (See also W72-01403) (Josefson-USGS W72-01404

**FLUCTUATIONS** OF TOTAL MINERALIZATION AND IONIC COMPOSI-TION OF LAKE WATERS IN THE SEMIARID ZONE VNUTRIVEKOVYYE KOLEBANIYA OBSHCHEY MINERALIZATSII I IONNOGO SOSTAVA VOD OZER SEMIARIDNOY ZONY, Laboratory of Limnology, Leningrad (USSR).

In: Ozera semiaridnoy zony SSSR; Izdatel' stvo 'Nauka', Leningrad, p 20-35, 1970. 5 fig, 2 tab, 13

Descriptors: \*Limnology, \*Lakes, \*Water chemistry, \*Salinity, \*Fluctuation, Water analysis, Water chemistry, \*Salinity, \*Eluctuation, Water analysis, Bicarquality, Ions, Salts, Chlorides, Sulfates, Bicarbonates, Sodium, Climatic data, Semiarid climates, Seasonal.

Identifiers: \*USSR, \*Kazakhstan, \*Mineralization, Lake Borovoye, Lake Bol'shoye, Chebach'ye, Lake

Three lakes in the Borovaya lake group of Kazakhstan--the Borovoye, Bol'shoye Chebach'ye and Maybalyk--were examined to study the changes in total mineralization and ionic composition of the lake waters for the period 1953-1964. An analytical method was proposed to distinguish seasonal fluctuations of total mineralization in lake waters from long-term secular variations. On the basis of data collected and theoretical arguments, fluctuations of total mineralization and ionic composition were defined for several lakes for a period of about 80 years. The data available on the mineralization and ionic composition of lake waters may, in some cases, be used to assess past general climatic indices. Changes in mineralization may be considered as a reaction to changes in the water level of a lake dur to drought or flooding. The hydrochemical regime of a lake may be regarded as an indicator of climatic fluctuations. (See also W72-01403) (Josefson-USGS) W72-01405

HYDROCHEMICAL DESCRIPTION OF LAKES IN SEMIARID REGIONS OF THE USSR (GIDROKHIMICHESKAYA KHARAK-TERISTIKA OZER SEMIARIDN OBLASTEY SSSR), Laboratory of Limnology, Leningrad (USSR). SEMIARIDNYKH

T. B. Forsh.

In: Ozera semiaridnoy zony SSSR; Izdatel'stvo 'Nauka', Leningrad, p 36-48, 1970. 5 fig, 1 tab, 4

Descriptors: \*Lakes, \*Limnology, \*Bodies of water, "Water chemistry, "Semiarid climates, Salinity, Sea water, Fresh water, Salts, Ions, Sulfates, Chlorides, Magnesium, Sodium, Sodium

sunate.

Identifiers: \*USSR, Kazakhstan, Akmolinsk Oblast, North Kazakhstan Oblast, Kokchetav Oblast, Semiarid regions, Sodium carbonate, Cations, Anions, Mineralization.

The chemical composition of lake waters in the semiarid zone from the lower Volga to the southeast corner of Kazakhstan was examined to explain the formation of salts in these bodies of water. Lakes of the semiarid zone are unique centers for the concentration of salts, and must be examined in their entirety as a many-sided manifestation of a single natural process. The formation of 'sea' salts is a natural phenomenon in the develop-ment of water bodies in a semiarid zone. Lakes of a sodium-carbonate composition may represent a second type of development. Bodies of water with a predominance of sulfates occupy a middle position between the 'sea' and sodium-carbonate types. The age of a lake plays an important role in explaining the ionic composition of lake waters in a semiarid zone. The distribution of ions in lake waters does not confirm the marine origin of a water body. (See also W72-01403) (Josefson-USGS) W72-01406

BASIC FEATURES IN THE GEOMORPHOLOGY OF BENCHES OF LAKE SHALKAR, KOKCHETAV OBLAST (OSNOVNYYE CHERTY GEOMORFOLOGII BEREGOVYKH VALOV SHALKAR, KOKCHETAVSKAYA OBLAST'),

Laboratory of Limnology, Leningrad (USSR).

In: Ozera semiaridnoy zony SSSR; Izdatel'stvo 'Nauka', Leningrad, p 75-91, 1970. 11 fig, 3 tab, 8

\*Limnology, \*Lakes, Descriptors: morphology, \*Lake morphonetry, \*Geomorphology, Lake shores, Slopes, Shape, Terraces (Geological), Abrasion, Aggradation, Banks, Bank erosion, Winds, Waves (Water), Water levels, Vegetation, Soils, Sediments, Particle size.
Identifiers: \*USSR, \*Benches, Kazakhstan,

Kokchetav Oblast, Lake Shalkar.

A large area of the shore of Lake Shalkar (Kokchetav Oblast) was examined in the summer of 1965 to study the distribution and structure of the shore formations of the lake. The number of benches along the shore and their shapes depend upon the slope of the banks. The thickness of the benches is greater at the higher lake levels and depends upon the particle size of the sediments deposited. Analysis of maximum bench heights made it possible to determine the maximum height of lake levels in the past. The maximum bench height was found to be 7.34 m higher than the 1965 lake level. (See also W72-01403) (Josefson-USGS) W72-01407

VEGETATION OF STEPPE LAKES NORTHERN KAZAKHSTAN AND ADJACENT AREAS (RASTITEL'NOST' STEPNYKH OZER SEVERNOGO KAZAKHSTANA I SOPREDEL'-NYKH S NIM TERRITORIY), Laboratory of Limnology, Leningrad (USSR).

V. M. Katanskaya. In: Ozera semiaridnoy zony SSSR; Izdatel'stvo 'Nauka', Leningrad, p 92-135, 1970. 13 fig, 2 tab, 47 ref.

Descriptors: \*Limnology, \*Lakes, \*Aquatic plants, Floating plants, Submerged plants, Pondweeds, Lake morphonetry, Lake morphology, Water chemistry, Water quality, Salinity, Bottom sediments, Depth, Topography, Orography, Grasslands Systematics

lands, Systematics. Identifiers: \*USSR, \*Geobotany, Siberia, Kazakhstan, Water plants, Hydrophytes, Aerohydrophytes, Plant communities, Reeds, Mineralization.

Over 600 lakes in the steppe and forest-steppe zone of Western Siberia and Northern Kazakhstan were examined in 1959-1962 to describe the morphometry, morphology, water chemistry, and plant communities of the lakes and to classify the lakes according to their vegetative cover. Of the 120 plant species (sporophytes and spermatophytes) comprising the lake flora, less than one-half are prevalent and even fewer are strong environment-forming species with biocoenoses extending over wide lake areas. A total of 14 lakes types were identified on the basis of their vegetation. The species most commonis (25-30%); the Phragmites communis (25-30%); the Phragmites communis .../Typha angustifolia/-Potamogeton lucens (6%). A scheangustifolia/Potamogeton lucens (6%). A schematic drawing of ecological areals of the lake types shows the position of each type of lake in the ecological series with respect to salinity and the character of the bottom sediments. (See also W72-01403) (Josefson-USGS) W72-01408

MICROBIOLOGY OF THE LAKES OF KAZAKHSTAN AND THE BARABAKULUNDA STEPPES (K MIKROBIOLOGII OZER KAZAKHSTANA I BARABO-KULUNDY), Laboratory of Limnology, Leningrad (USSR). D. N. Aleksandrova.

In: Ozera semiaridnoy zony SSSR; Izdatel'stvo 'Nauka', Leningrad, p 136-144, 1970. 6 tab, 17 ref.

Descriptors: \*Limnology, \*Lakes, \*Aquatic microbiology, \*Aquatic bacteria, \*Aquatic Descriptors: \*Limnotogy, Labos, microbiology, \*Aquatic bacteria, \*Aquatic microorganisms, Nitrogen fixing bacteria, Nitrogen fixation, Saline water, Salinity, Salts, Brackish water, Bodies of water, Organic matter.

Identifiers: \*USSR, Kazakhstan, Baraba Steppe, Kulunda Steppe, Saprophytes, Mineralization.

A total of 36 lakes belonging to lake groups of the Syr-Darya River delta, the lower reaches of the Ulu-Zhilanchik River, the upper reaches of the Turgay River, the Kokchetau (Borovyye) mountain range, the Baraba and Kulunda Steppes, and the Alakul' basin were examined (1963) to study the bacteria content of the lakes and the nitrogen-fixing capacity of the lake waters. A microbiological ing capacity of the lake waters. A microbiological description is given of perennial and intermittent lakes and is accompanied by an examination of 5 saline lakes characterized by large concentrations of salt. The nitrogen-fixing capacity of the perennial and intermittent lakes is 0.00-0.90 and 4.0-36.0 mg/liter, respectively. The nitrogen-fixing capacity of the saline waters is 0.0 mg/liter. The maximum number of bacteria (11-13 million/ml) were observed in the brackish water bodies; the minimum number of microoreanisms (0.4-0.8 million/ml) number of microorganisms (0.4-0.8 million/ml) were found in the saline lakes. The maximum number of saprophytes were observed in the brackish intermittent and saline lakes and ranged from 800 to 1,800 cells/ml of water. (See also W72-01403) (Josefson-USGS)

GROUNDWATER IN LAKE BASINS OF THE SARPINSKAYA DEPRESSION (GRUNTOVYYE VODY NEKOTORYKH OZERNYKH KOT-LOVIN SARPINSKOY LOZHBINY), Laboratory of Limnology, Leningrad (USSR).

L. A. Zemlyanitsyna.

In: Ozera semiaridnoy zony SSSR; Izdatel'stvo 'Nauka', Leningrad, p 145-157, 1970. 5 fig, 5 tab, 5

Descripto \*Salinity, Sodium of Water of Slopes. Identifier depressio Khanata, tions, An

On-site i 1958, an Caspian rence in the groun shore of m. Grou between from calc roundw Barmant from the that of t water mi is graphi W72-014

THE N GROUN TRATSI Laborato L. A. Zei In: Ozer 'Nauka', ref. Descript dies, \*R

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compare tial metl method moveme of the L bility--0. slope of the elec creased part of dicated 3 times and a dischare of groun possibili directio low flow

MARIN POND RAZIJ Laborat V. M. K In: Oze Nauka' 8 ref.

W72-01 W72-01 Descriptors: \*Lakes, \*Lake basins, \*Groundwater, \*Salinity, \*Salts, Bicarbonates, Chlorides, Sulfates, Sodium chloride, Sodium sulfate, Calcium, Ions, Water chemistry, Water levels, Water table,

Identifiers: \*USSR, Caspian Sea, Sarpinskaya depression, Lake Barmantsak, Lake Prishib, Lake Khanata, Calcium bicarbonate, Mineralization, Cations, Anions.

On-site investigations were conducted in 1954, 1958, and 1962 on the Barmantsak, Prishib, and Khanata Lakes in the Sarpinskaya depression of the Caspian Sea lowland to study groundwater occur-rence in lake basins and to establish a relationship between groundwater and lake levels. The depth to the groundwater table in coastal areas of the Barmantsak and Prishib Lakes and on the southeast shore of Lake Khanata varies between 0.5 and 3.5 m. Groundwater mineralization, which varies between 0.6 and 23 g/liter, ranges in composition from calcium-bicarbonate to sodium-chloride. The groundwater table along the eastern shores of the Barmantsak and Prishib Lakes slopes eastward from the lake and has a mineralization greater than that of the lake waters. The increase in groundwater mineralization with distance from the shore is graphically shown for the lakes examined. (See also W72-01403) (Josefson-USGS) W72-01410

#### THE NATURAL ELECTRICAL FIELD AND GROUNDWATER MOVEMENT (YESTESTVENNOYE ELEKTRICHESKOYE POLE I FIL'-TRATSIYA GRUNTOVYKH VOD),

Laboratory of Limnology, Leningrad (USSR).

L. A. Zemlyanitsyna.

In: Ozera semiaridnoy zony SSSR; Izdatel'stvo 'Nauka', Leningrad, p 158-171, 1970. 7 fig, 2 tab, 3

Descriptors: \*Borehole geophysics, \*Electrical studies, \*Resistivity, \*Groundwater, \*Groundwater movement, Hydrogeology, Aquifers, Exploration, Base flow, Water storage, Water levels, Water ta-ble, Ravines, Loam, Boreholes, Reservoirs, Trans-

Identifiers: \*USSR, Kursk Oblast, Uspenskoye Reservoir, Spontaneous polarization, Spontane potential method, Self-potential meth method. potential me Mineralization.

Experimental hydrogeological investigations were conducted in the summer of 1960 in three ravines near the Uspenskoye Reservoir (Kursk Oblast) to compare data obtained by the spontaneous potential method with that of direct groundwater observations and to determine the applicability of the method for quantitative estimation of groundwater movement. A 1-m depth groundwater flow in loam of the Lubyanoy ravine (coefficient of transmissi-bility--0.004 m/day) at a depth of about 1 m and a slope of 0.0074 produced an average increase in the electrical potential of 0.4 mv/100 m. An increased electrical potential to 1.1 mv/100 m in the part of the Rzhavets ravine below the dam indicated a slope of the groundwater table in the area 3 times that in the upper reaches of the reservoir and a threefold increase in the groundwater discharge to 0.009 cu m/day. Direct observations of groundwater flow and a study of its natural electrical field by spontaneous polarization confirm the possibility of using the method to determine direction of groundwater movement even at very low flows and small volumes of storage. (See also W72-01403) (Josefson-USGS)

#### MARINE OVERGROWTH IN THE POLIVNOY POND IN LOW- AND HIGH-WATER YEARS (ZARASTANIYE PRUDA POLIVNOGO V RAZLICHNYYE PO VODNOSTI GODY),

Laboratory of Limnology, Leningrad (USSR).

V. M. Katanskaya.

In: Ozera semiaridnoy zony, SSSR; Izdatel'stvo 'Nauka', Leningrad, p 232-252, 1970. 14 ref, 2 tab,

Descriptors: \*Limnology, \*Ponds, \*Aquatic plants, Floating plants, Submerged plants, Pondweeds, Grasses, Water levels, Water level fluctuations, Discharge (Water), Shores, Shore-line cover, Seasonal.

Identifiers: \*USSR, Volgograd Oblast, Water plants, Plant communities, Plant associations, Phytocoenoses, Reeds.

Marine overgrowth in the Polivnoy Pond, Vyazov-skiy Rayon, Volgograd Oblast was examined in the low-water year of 1950 and in the high-water year of 1958 to study the distribution of plant associa-tions in the pond and to analyze the changes in its vegetative cover during these years and in the low-water year of 1954 and in the high-water year of 1955. A reduction in the volume of the pond and in its surface area in dry years leads to a marked decrease in the floral and coenotic diversity of the coastal aquatic vegetation, including a disappearance of submerged plants and plants with floating leaves. In dry years some associations of water plants (Phragmites communis, Typha angustifolia, etc.) on parched sections of the shore are enriched by various mesophilic mixed-grass species. In wet by various mesophilic mixed-grass species. In wet years the vegetation in the pond is luxuriant and varied and occupies a much wider area than in dry years. Variations in the vegetation of the Polivnoy Pond range from a complete disappearanceof some phytocoenoses to the appearance of new ones and depend upon the meteorological conditions and flooding of the area and upon the water content of the pond. (See also W72-01403) (Josefson-USGS) W72-01412

#### OBSERVATIONS OF SOIL EVAPORATION AND PLANT TRANSPIRATION IN AN ESTUA-RY IN WEST KAZAKHSTAN (NABLYUDENIYA NAD ISPARENIYEM S POCHVY I TRANS-PIRATSIYEY RASTITEL'NOSTI LIMANA V ZAPADNO-KAZAKHSTANSKOY OBLASTI),

Laboratory of Limnology, Leningrad (USSR). G. V. Nazarov, and M. E. Grodzitskiy.

In: Ozera semiaridnoy zony, SSSR; Izdatel'stvo 'Nauka', Leningrad, p 253-258, 1970. 2 fig, 2 tab.

\*Evaporation, \*Estuaries, Soils, Plants, Vegetation, Grasslands, Soil moisture, Water storage, Consumptive use, Snowmelt, Runoff, Precipitation (Atmospheric), Evaporation pans.
Identifiers: \*USSR, West Kazakhstan, Ural'sk

Oblast, Chapayevo Rayon, Steppes.

Observations of soil evaporation and plant transpiration were conducted in 1954-55 in 3 areas of the Kuyyun'kol' estuary located 6 km south of Bulan village, Chapayevo Rayon, Ural'sk Oblast (West Kazakhstan). The areas examined were (1) an estuarine depression bordering a zone of reed growth; (2) an outlying region of the estuary; and (3) an adjoining steppe. Less moisture was lost to evaporation in the dry steppe than in the estuary where the soil stored snowmelt runoff. In the wet-test part of the estuary a large portion of the moisture was evaporated by transpiration. Trans piration in the middle part of the estuary was 41% in 1954 and 51% in 1955. The transpiration values in the steppe during the same period were 25% and 36%, respectively. In the drier part of the estuary the transpiration values ranged between these limits. (See also W72-01403) (Josefson-USGS)

#### HYDROLOGIC REGIME OF LAKE HERTEL, McGill Univ., Montreal (Quebec). Dept. of Civil

Engineering.

Journal of American Water Works Association, Vol 63, No 10, p 671-675, October 1971. 9 fig, 4 tab, 5 ref.

Descriptors: \*Water resources development, \*Hydrology, \*Hydrologic data, \*Water supply, \*Lakes, Hydrologic cycle, Inflow, Streamflow, Seepage, Evaporation, Water yield, Precipitation (Atmospheric), Runoff, Snowmelt, Water demand,

Data collections, Hydrographs, Water level fluc-Identifiers: \*Lake Hertel (Quebec, Canada).

The hydrologic regime of Lake Hertel in Quebec, Canada is evaluated to give a better insight into the potentialities of the lake as a source of water supply for the town of Beloeil. The average runoff coeffi-cient calculated from observed data of the hydroocean calculated from observed data or the hydrograph for July and August 1962, was 0.0198 and 0.0232 for the drainage basins contributing to the west and north creeks, respectively. Areas contributing to these two creeks together constitute 72% of the total drainage area contributing to Lake Hertel. The total evaporation from the water surface of Lake Hertel was estimated to be 1.316 inches, based on evaporation-pan data reduced by the average pan coefficient of 0.7. With proper provision for storage, the snow-melt runoff over the outflow weir could augment Beloeil's water supply for nearly five months. (Woodard-USGS) W72-01418

# WAVE CLIMATE STUDY, GREAT LAKES AND GULF OF ST. LAWRENCE, VOLUME 1, National Research Council of Canada, Ottawa

(Ontario). Div of Mechanical Engineering.

J. Ploeg.
Canada National Research Council Mechanical
Engineering Report DME-MH-107A, March 1971.
154 p, 10 fig, 5 tab, 14 ref.

Descriptors: \*Waves (Water), \*Great Lakes, \*Gulfs, \*St Lawrence Seaway, \*Hydrologic data, Data collections, Turbulence, Dimensions, Length, Height, Frequency, Ships, Navigation, Winds, Surface waters. Identifiers: \*Wave climate, \*Gulf of St. Lawrence.

Wave climate of the Great Lakes and the Gulf of St. Lawrence was studied over a period of three years. Waves were recorded at 14 locations, and over 18,000 useful records were collected. The waves were observed with an accelerometer type wave sensor, recorded on magnetic tape, and analyzed by means of power spectral density techniques. The significant wave height and the period of the peak of the energy spectrum define a particular sea state. Some wave parameters, directly related to design criteria, were computed and are included in the tables. The study was made concerning the possibility of changing the present shipping regulations to allow vessels, designed for Great Lakes wave conditions, to operate beyond the inland water limits into the Lower Gulf of St. Lawrence, and also of changing the load-line regulations to allow deeper loading for extended navigation seasons. The wave conditions in the Upper Gulf are comparable to those of the Great kes. The Lower Gulf of St. Lawrence, however, is exposed to ocean swell with much longer wave periods than can be expected in the inland water. (Woodard-USGS) W72-01524

CHARACTERISTICS OF SEDIMENT TRANS-PORT IN THE COASTAL ZONE OF LAKE IS-SYK-KUL' (NEKOTORYYE OSOBENNOSTI PEREMESHCHENIYA NANOSOV V BEREGOVOY ZONE OZERA ISSYK-KUL'),

Moscow State Univ. (USSR). Research Lab. of Soil

For primary bibliographic entry see Field 02J. W72-01544

FOREIGN INVESTIGATIONS OF RECENT DOLOMITE SEDIMENTS IN MARINE BASINS (ZARUBEZHNYYE ISSLEDOVANIYA SOVREMENNYKH DOLOMITOVYKH OSAD-KOV V MORSKIKH VODOYEMAKH), Akademiya Nauk SSSR, Moscow. Geologicheskii

Institut For primary bibliographic entry see Field 02J. W72-01548

#### Group 2H-Lakes

11TH TECH MEETING OF THE INTERNAT'L UNION FOR NATURE CONSERVATION AND NATURAL RESOURCES, 1ST AND 2ND SES SIONS. COMMISSION ON ECOLOGY SECTION THE INTERNAT'L BIOLOGICAL PRO-GRAM CURRENT RESEARCH IN INDIA, AND ITS R ELEVANCE TO CONSERVATION. NEW DELHI, INDIA, NOV. 25-28, 1969, INDIA, NOV. 25-28, 1970,

Publ N S. 17: 1970. 230-280. (See also W72-

Identifiers: Biological, Commission, Conservation, Identuriers: Biological, Commission, Conservation, Current, Ecology, India, International, Meeting, Natural, Nature, Nd, New-Delhi, Program, Relevance, Resources, Section, Sessions, St, Symposium, Technical, Th, Union.

#### STUDIES ON THE ECOLOGY AND CONSER-VATION OF FRESHWATER LAKES OF KASH-

S. M. Das.

IUCN (Int Union Conserv Nature Natur Resour) Publ N S. 17: 1970, 277-280.

Identifiers: Conservation, Ecology, Economic, Fish, Fresh, India, Kashmir, Lakes, Species, Water.

#### 2I. Water in Plants

SELECTION IN FOURSPINE HABITAT STICKLEBACKS (APELTES QUADRACUS), Yale Univ., New Haven, Conn. Peabody Museum

of Natural History. Myron Charles Baker.

Amer Midland Natur. 85 (1): 239-242. 1971.

Identifiers: Apeltes-Quadracus, Elodea-Canadensis-M, Fourspine, Habitat, Potamogeton-Praelongus-M, Selection, Sticklebacks.

This study describes the range of microhabitats potentially availably to A. quadracus in a freshwater stream. An experiment was performed to see if the fish could discriminate between one of the major components of its normal microhabitat, the plant Elodea canadensis, and other plant, Potamogeton praelongus, found in immediately adjacent microhabitats where these fish did not oc-cur. Individuals were given trials of 20 min in a test tank uniformly planted half with Elodea and half with Potamogeton. The fish showed a significant preference for Elodea under these conditions.—Copyright 1971, Biological Abstracts, Inc. W72-01198

#### WEIGHT-LENGTH REGRESSION MODELS FOR THREE AQUATIC GASTROPOD POPULA-

Cornell Univ., Ithaca, N. Y. Dept. of Entomology. James W. Eckblad.

Amer Midland Natur, 85 (1): 271-274, 1971. Identifiers: Aquatic, Biomass, Gastropod, Length, Method, Models, Population, Regression, Weight.

The regression between shell length and shell-free dry weight was calculated to obtain biomass estimates of 3 natural populations of aquatic snails. This method enables the investigator to make biomass estimates for relatively small populations when it is desirable to regurn sampled individuals to the population.—Copyright 1971, Biological Abstracts, Inc. W72-01199

#### THE EFFECT OF INUNDATION AND CHOICE OF HIBERNATION SITES OF COLEOPTERA LIVING ON RIVER BANKS,

Tromso Museum (Norway). Johan Andersen.

Nor Entomol Tidsskr. 15 (2): 115-133. Illus. 1968. Identifiers: Banks, Bembidion-Lunatum, Bledius, Coleoptera, Dyschirius, Hibernation, Hypnoides, Inundation, Living, Morychus-Dovrensis, Nebria-Gyllenhali, River, Sites.

This investigation deals with the effect of inundation upon arthropods and, especially, Coleoptera living on river banks, and on their choice of hibernation sites. The water level in 5 rivers in central and northern Norway was studied, and various collection methods were employed during inundation periods on 2 of the rivers (the Gaula in Sor-Trondelag and Malselva in Troms). Observations of behavior and experiments on tolerance to water were undertaken. The longest periods with inundations, caused by snow melting in the mountains, occur in May, June, and part of July, dependent upon the geographical position of the river and the height above sea level of the catchment areas Despite an unusually long inundation period on the Gaula in 1965, the imaginal populations of Coleoptera seemed to be intact after the spring flood, and even larvae and pupae, and probably also eggs, survived the inundations. The arthropods have different ways of surviving the spring floods. On evenly sloping banks the epigeic arthropods move upwards, gradually, as the water level rises. If the spots are surrounded by more low-lying areas and are completely submerged, the arthropods living there are taken by the water. The survival time of some adult Coleoptera submerged in water was short, but as they soon tend to land among scum and twigs on trees and bushes, their chances of surwings of the sand outsides, that chances of surviving are great. Eggs, pupae, most larvae, and some of all fossorial Coleoptera stages survive submerged in the river. Their chance of survival is probably less on coarse substratum (stone, gravel, coarse sand), than on fine material (fine sand, silt). coarse sand), than on tine material (tine sand, silt). Imagines of several species of Bembidion, Dyschirius spp., Hydnobius spp., Bledius spp., Hypnoides spp., Morychus dovrensis Munst., and larvae of Bembidion lunatum Dft., Nebria gyllenhali Schnh., and several Staphylinidae at least partly hibernate on the river bank.—Copyright 1971, Biological Abstracts, Inc. W72-01201

#### THE ZONAL BIOCENOSES OF A HYDRO-

GRAPHIC NETWORK, (IN FRENCH), Aix-Marseille Univ. (France). Faculte

Jean Giudicelli.

Ann Fac Sci Marseille. 43B: 107-125. Illus. Map. 1970. English summary.

Identifiers: Animal, Biocenoses, Hydrographic, Italy, Network, Population, Zonal.

In a central Corsica river system, 5 successive biocenoses were recognized along the course of the main river. The animal populations of the tributaries are related and compared with those of the main river.--Copyright 1971, Biological Abstracts, W72-01214

#### SOME EFFECTS OF SUMMER FLOODS ON **WOODWALTON FEN IN 1968/69,**

Nature Conservancy, Abbots Ripton (England). Monks Wood Experiment Station.

Eric Duffey, and Gordon Mason Entomol Gaz. 21 (1): 23-26. 1970.

Identifiers: Cirsium-Dissectum-D, England, Fen, Floods, Luzula-Pallescens-M, Lycaena-Dispar-Batavus, Mortality, Summer, Woodwalton.

A period of extensive flooding of a nature reserve near Huntingdon, England due to excessive rainfall during the summer of 1968 destroyed most of the breeding of Lycaena dispar batavus (Lepidoptera) and during 1969 the butterfly became locally extinct. This species had been introduced into the Fen in 1927 and had been observed yearly until the flooding. Several of the rarer plant species, Luzule pallescens and Cirsium dissectum, were not observed during 1969 while reeds were more abundant that year.--Copyright 1971, Biological Ab-W72-01219

#### DENSITY AND BEHAVIOR OF STOMATA OF PELARGONIUM HORTORUM AIT. GROWN UNDER THREE SOIL MOISTURE REGIMES, consin Univ., Madiso

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A. W. Metwally, G. E. Beck, and B. Esther

J Amer Soc Hort Sci. 96 (1): 31-35, Illus, 1971. Identifiers: Behavior, Density, Diffusion, Growth, Grown, Leaves, Moisture, Pelargonium-Hortorum-D, Porometer, Regimes, Soil, Stomata.

Two cultivars of Pelargonium hortorum were exposed to 3 soil moisture regimes for 10 wk at which posed to 3 soil moisture regimes for 10 wk at which time rubber silicone impressions were made of the abaxial leaf surface of young and old leaves. 'Dark Red Irene' leaves had fewer stomata per unit area and greater diffusion resistance than did 'Princess Irene' exposed to the same regime. Increase in soil water content promoted the differentiation of sto-mata in early stages of leaf development. As the leaves increased in size and matured the number of stomata per unit area became inversely related to soil moisture content as a result of increased leaf area with high soil moisture. The stomatal re-sistance, determined by diffusion porometer, in young leaves of both cultivars was highest for plants grown in soils with high moisture and lowest with medium moisture.--Copyright 1971, Biological Abstracts, Inc. W72-01222

#### GERMINATION AND GROWTH OF NEU-ROSPORA AT LOW WATER ACTIVITIES, California Inst. of Tech., Pasadena.

Gisela Wohlrab Charlang, and N. H. Horowitz. Proc Nat Acad Sci USA. 68 (2): 260-262 Illus

Identifiers: Chloride, Conidia, Germination, Growth, Low, Neurospora, Sodium.

When the water activity (aw) of the medium is lowered by the addition of NaCl or nonelectrolytes, an inhibition of germination, growth rate, and total growth is observed in Neurospora crassa. Inhibition of conidial germination is separable from the other effects and is caused, in large measure, by the loss from conidia in media of low water activity of a substance that is essential for their germination.

The substance is detectable in the medium and is also extractable from cultures. It is dialysable and thermostable, and it appears to be highly active. It is not detectable in complete medium.--Copyright 1971, Biological Abstracts, Inc. W72-01223

## EFFECT OF ERRORS IN MEASURING LEAF TEMPERATURE AND AMBIENT GAS CON-CENTRATION ON CALCULATED RE-SISTANCES TO CO2 AND WATER VAPOR EXCHANGES IN PLANT LEAVES, Australian National Univ., Canberra. Research

School of Biological Sciences.

R. O. Slatyer.

Plant Physiol. 47 (2): 269-274 Illus 1971.

Identifiers: Ambient, Calculated, Carbon, Concentration, Di, Errors, Exchanges, Gas, Leaf, Leaves, Measuring, Mesophyll, Oxide, Plant, Resistances, Stomata, Temperature, Vapor.

Errors as small as 1 C in the measurement of leaf temperature T (leaf) are shown to cause significant changes in the estimated value of the stomatal resistance (expressed in terms of total resistance to water vapor transfer, Sigma (r (H2O)). The effect increases as T (leaf) increases and as ambient rela-tive humidity increases, if other conditions are maintained constant. The effect on the key CO2 exchange parameter, the intracellular (or mesophyll) resistance, r (int), tends to be small open stomata conditions but rapidly as stomatal closure occurs, particularly if the true value of r (int) is relatively small. Errors in the determination of the ambient water vapor and CO2 concentrations can also significantly affect the calculated value of Sigma (r (H2O)) and r (int). The effect on Sigma (r (H2O)) and Sigma (r (CO2)) increases as the ratio of the inlet/outlet concentration departs from unity and also increases as the assumed leaf-air concentration difference decreases. The combined effect on r (int) tends to be less than the individual effects on Sigma (r (H2O)) and Sigma (r (CO2)) since both are in same direction.

THE INFLUENCE OF AN INCREASED WATER DEFICIT ON THE GAS EXCHANGE PROCESSES IN WHEAT PLANTS,

NAVORINGIAISTICATION, NAVORINGIAISTICATION,

TREE GROWTH AND FOREST SOILS PROCEEDING OF THE 3RD NORTH AMERICAN FOREST SOILS CONFERENCE HELD AT NORTH CAROLINA STATE UNIVERSITY AT RALEIGH IN AUGUST 1968, For primary bibliographic entry see Field 02G. W72-01259

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PLANT WATER STATUS OF APPLE TREES AND ITS MEASUREMENT IN THE FIELD: I. THE DYE TECHNIQUE FOR MEASUREMENT OF LEAF WATER POTENTIAL,

Department of Primary Industries, Applethorpe (Australia). Granite Belt Horticulture Research

For primary bibliographic entry see Field 03F. W72-01271

AGE AND GROWTH OF THE AMERICAN EEL (ANGUILLA ROSTRATA (LE SUEUR) IN NEW-FOUNDLAND WATERS, New Brunswick Univ., Fredericton. Dept. of Biolo-

gy. R. W. Gray, and C. W. Andrews. Can J Zool. 49 (1): 121-128. Illus. 1971. (Fr.

summ.).

Identifiers: Age, American, Anguilla-Anguilla, Anguilla-Rostrata, Canada, Eel, Growth, Migration, Newfoundland.

The age (otolith readings) and growth of A. rostrata from fresh and brackish waters in Newfoundland were studied. The eels in Burnt Berry Brook grew faster than eels in the other areas. The of young eels in brackish water was slow. Although the growth of these eels increased in subsequent age groups, freshwater eels were consistently larger at each age. The silver eel migrates after spending 12 to 13 yr in Newfoundland waters. The American eel in Newfoundland is generally larger than the European eel (A. anguilla L.) at the onset of migra-tion; however, its appearance and state of maturity parallel the condition described in the European eel.--Copyright 1971, Biological Abstracts, Inc. W72-01288

THE CARRYING CAPACITY FOR JUVENILE SALMONIDS IN SOME NORTHERN CALIFOR-NIA STREAMS,

California State Dept. of Fish and Game, Sacra-

mento. James W.Burns.

Calif Fish Game. 57 (1): 44-57. Illus. 1971. Identifiers: California, Juvenile, Northern, Oncorhynchus-Kisutch, Salmo-Clarki, Salmo-Gairdneri, Salmonids, Streams.

Standing crops of juvenile coho (silver) salmon, Oncorhynchus kisutch, steelhead rainbow trout, Salmo gairdneri, and coast cutthroat trout, Salmo were examined in seven coastal streams to define the natural carrying capacity of these streams, and to develop methods of population comparison and prediction which could be used to determine the effects of road construction and logging on salmon and trout production. Biomass per unit of surface area was the best method of expressing carrying capacity, because biomass was better correlated with stream surface area than

with other parameters tested. Volume of streambed sediments, total dissolved solids, alkalinity, and total phosphate in 6 streams were not satisfactory predictors of carrying capacity. Only living-space variables correlated significantly with biomass. Not variables correlated significantly with biomass. Not all streams reached carrying capacity in the summer and salmonid biomass was highly variable. Even with 3 yr of prelogging study, it would be difficult to attribute a change in carrying capacity under 50% to anything but natural variation.—Copyright 1971, Biological Abstracts, Inc. W72-01291

THE EFFECT OF COHO (ONCORHYNCHUS KISUTCH) SPAWNING ON THE BENTHIC INVERTEBRATES OF THE PLATTE RIVER, BENZIE COUNTY, MICHIGAN, Michigan Univ., Ann Arbor. Dept. of Wildlife and Eitheries.

Stephen G. Hildebrand.

Trans Amer Fish Soc. 100 (1): 61-68. Illus. 1971. Identifiers: Benthic, Benzie, Coho, County, Invertebrates, Michigan, Oncorhynchus-Kisutch, Platte, Population, River, Spawning.

This study was undertaken to determine what ef-This study was undertaken to determine what effects a spawning run of coho salmon would have on the benthos of the Platte River, Benzie County, Michigan. It was hypothesized that the physical disruption of the substrate, by spawning salmon, would reduce the density of benthos by dislodging the organisms and causing their downstream displacement. Estimates of density of benthic inverseptions of the state o tebrates were made in 2 control (salmon excluded) and in one experimental section (salmon having free access) in May and Aug. 1967 prior to coho spawning run, and in Dec. 1967 and May 1968 after the run. Coho spawning activity in the fall of 1967 dis-virbed in bottom materials. The densities of 12 taxa, as well as the total number and total weight of organisms per square foot, decreased sig-nificantly in samples collected Dec. after disrup-tion. The decrease in total number of organisms per square foot in the experimental section as compared to the controls was 270.5; the decrease in weight in the experimental section was 1.97 g. This weight in the experimental section was 1.37 g. This is a percent decrease in the experimental section relative to the controls of 66% for total number and 78% for total weight. In May 1968, the number of organisms per square foot was still significantly lower in the experimental section (57.4/sq ft), but weight of organisms per square foot was not. The percent decrease in the experimental section relative to the controls for total number was 39%. Three of 12 taxa, whose density was reduced in the fall of 1967, were still lower in May 1968. Complete recovery of benthos was not observed in the 5-mo. period from Dec to May-Copyright 1971, Biological Abstracts, Inc. W72-01293

OPERATION OF ABERNATHY CHANNEL FOR INCUBATION OF SALMON EGGS, Bureau of Sport Fisheries and Wildlife, Longview,

Calif. Salmon Culture Lab.
Allan E. Thomas, and J. M. Shelton.
U S Bur Sport Fish Wildl Tech Pap. 23. 3-19. Ilus.

Identifiers: Abernathy, Channel, Development, Egg, Eggs, Incubation, Oncorhynchus-Keta, On-corhynchus-Tshawytscha, Operation, Planting, Salmon, Washington.

A spawning and incubation channel constructed in 1959 on Abernathy Creek near Longview, Washington, was used for seasons to incubate fall chinook salmon (Oncorhynchus tshawytscha) and chum salmon (O. keta) eggs. Survival of eggs from both species was higher than reported for other channels and controlled-flow projects. Studies in-cluded effects of sedimentation, egg planting densi-ty, and stage of egg development at planting on survival. In early experiments sediment in the upper sections substantially reduced survival. In later experiments, after the construction of a sand trap and settling chamber, survivals were significantly in-creased. Planting densities were increased to a maximum of 435 eggs/ft sq without significant reduction in survival. This is about 3 times that recommended for spawning channels. Peak migrations occurred at about 1800 temperature units for chinook salmon and 1700 temperature units for chum salmon. Survivals from eyed egg to migrant for chinook salmon was from 68.0 to 78.5%. Survivals statement of the salmon was from 68.0 to 78.5%. tor chinook salmon was from 68.0 to 78.5%. Survivals for chinook eggs planted before water hardening was 14.6% but the results were influenced by unfavorable water temperatures. Survivals for chum salmon ranged from 75.3 to 95.5% for eyed-egg plants; 87.8% for water-hardened, green-egg plants; and 71.9% for pre-waterhardened green-egg plants.—Copyright 1971, Biological Abstracts, Inc.
W72.01301 W72-01301

STUDIES ON ARGEMONE MEXICANA LINN: IV. PHENOLOGY, DISPERSAL AND STO-

MATA, Kurukshetra Univ. (India). Dept. of Botany.

M. L. H. Kaul.

Proc Nat Acad Sci India Sect B Biol Sci. 39 (1/2): 121-128. Ilus. 1970.

Identifiers: Argemone-Mexicana-D, Dispersal, India, Moisture, Phenology, Seed, Stomata.

Phenological indicate Argemone mexicana is a winter annual at Varanasi. The phenology is con-siderably influenced by the habitat. Plants growing in moist shady areas persist longer and develop more slowly at Varanasi and its outskirts than those growing in exposed and dry areas. Seeds are dispersed by wind, water and animals. The effectiveness of wind dispersal was experimentally stu-died. The stomatal frequency and index on the dorsal surface are much higher than on the ventral surface. These values decrease from apex to base. The stomatal frequency is considerably higher in dry and exposed habitats than in moist and shady habitats.—Copyright 1971, Biological Abstracts, W72-01303

MEASUREMENTS OF COMMUNITY METABOLISM IN SOME BALTIC BRACKISH WATER ROCKPOOLS BY MEANS OF DIEL

OXYGEN CURVES, Stockholm Univ. (Sweden). Dept. of Zoology. Bjoin Ganning, and Fredrik Wulff. Oikos. 21 (2): 292-298. Illus. 1970.

Identifiers: Algae, Baltic, Brackish, Community, Curves, Diel, Lemna-M, Measurements, Metabolism, Oxygen, Photosynthesis, Pools, Rock

Estimates of community metabolism were made in some Baltic brackish water rockpools by the 'diel oxygen technique.' The rockpools are especially suitable for this method because of their well-defined and usually unstratified water bodies. Primary production values (gross photosynthesis) of between 2.7 and 21.8 g O2.m-2 day-1 and commu-nity respiration values between 2.7 and 18.2 g O2.m-2 day-1 were recorded. Variations between individual pools could be explained by deviations in geomorphology and biology. These productivity figures, measured during the summer, are high, even compared with tropical shallow water ecosystems. Photosynthesis exceeds respiration in all the pools and these autotrophic conditions are generally found throughout the year in spite of a heavy load of nutrients and a limited exchange of heavy load of nutrients and a limited exchange of water with the sea. The photosynthetic efficiency is highest in the early afternoon in pools with dominating benthic macroflora but in the morning and later afternoon hours in pools with dominating planktonic microalgae. A Lemna cover on the sur-face of a pool effectively prevents metabolic processes in the water, measurable by the method used.—Copyright 1971, Biological Abstracts, Inc. W72-01312

AQUATIC-BOG VEGETATION OF FISHING PONDS OF THE TASHKENT OBLAST, (IN RUS-

T. T. Taubaev, S. Keldibekov, and M. Abdiev.

#### Group 21-Water in Plants

Uzb Biol Zh. 14 (2): 39-42. 1970. English summa-

Identifiers: Aquatic, Batrachium-Divaricatum-D, Bog, Cynodon-Dactylon-M, Fishing, Marsilia-Quadrifolia-P, Najas-Gramineae-M, Polygonum-Nodosum-D, Ponds, Tashkent, USSR, Vegetation.

Polygonum nodosum, Marsilia quadrifolia, Batrachium divaricatum, Najas gramineae, and Cynodon dactylon are widely represented while they are completely absent or are in ponds of the European section of the USSR .-- Copyright 1971, Biological Abstracts, Inc. W72-01318

ECOLOGICAL PHYSIOLOGY OF SOME DESMIDS. I. A. MODE OF NITRATE UTILIZA-

Institut Royal des Sciences Naturelles de Belgique, Brussels.

C. Van Der Ben.

Hydrobiologia. 36 (3/4): 419-442. Illus. 1970. En-

glish summary. Identifiers: Dark, Desmids, Ecological, Mode, Nitrate, pH, Physiology, Reductase, Temperature.

The nitrate-reductase activity of some desmids collected during the stationary phase of culture was observed in vivo. Within the limits of pH corresponding to the natural biotopes, the reduction of nitrates is not followed by any valuable utilization of the nitrates produced; it is specifically influenced by pH; it increases with temperature within the experimented limits (from 22 deg to 38 deg); increasing also with the concentration of the nitrate up to a saturation value which is higher than the nitrate values observed in nature: the reduction of nitrate is more active in the dark than in the light. Some characteristics of the nitrate-reductase activity seem to be related to some of the ecological aspects of desmids .-- Copyright 1971, Biological Abstracts, Inc. W72-01319

RAIN FORESTS AND GONDWANALAND,

Victoria Univ., Wellington (New Zealand). Dept. of Botany.

J. W. Dawson Tuatara. 18 (2): 94-95. 1970.

Identifiers: Climate, Forests, Gondwanaland, Moist, Rain, Temperate.

The fact that this forest type favors higher altitudes in the tropics suggests that it evolved under mild, moist temperate rather than tropical conditions. A more or less constantly moist condition without Copyright 1971, Biological Abstracts, Inc.
W72-01320

COMPARATIVE ECOLOGY OF MONTANE AND DESERT REPROSOS (CATTLE WATER-ING-IMPOUNDMENTS) IN SOUTHERN NEW, MEXICO,

New Mexico State Univ., IUniversity Park, Dept. of

Biology. Walter G. Whitford, and Henry Becker.

Available from the National Technical Information Service as PB-204 496, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, New Mexico Water Resources Research Institute, Las Cruces, Oct 27, 1971. 83 p, 26 fig, 5 tab, 25 ref, 5 append. OWRR A-019-NMEX (1).

Descriptors: \*Ecology, \*Biomass, \*Invertebrates, Productivity, Carnivores, Plankton, \*Impound-ments, New Mexico, Vertebrates, Ecosystems, Daphnia, Salomondes, Predation, Snails, Diptera, Capepods.

Identifiers: \*Montane pond, Damsel flies, Fariy shrimp, \*Desert reprosos, Corixids,

The ecological relationships of a montane and desert reprosos (cattle watering impoundments) were studied over a three year period. Invertebrate productivity in the montane pond was greater than in the desert reprosos in summer. Invertebrate populations in the desert pond went through rapid succession in species composition and density fol-lowing late summer filling. Fairy shrimp and Daphnia were replaced by back swimmers (Buenoa) corixids and copepods. These inver-tebrates served as a food base for salamanders, Ambystoma tigrinum in which population dynamics were tied to the changing volume cycle of the desert pond. In the montane pond, the dominant invertebrates were damsel flies (Ishura) snails (Heliosoma) and Chironomids. Larval salamanders were the top carnivore in this reprosos since adults leave the pond after breeding. Quantitative esti-mates of annual changes in plankton, invertebrate and vertebrate numbers and biomass were used to describe the functional relationships of these ecosystems. Recommendations for culture of salamanders, A. tigrium as bait animals were based on the data from this study. W72-01340

LAKES OF THE SEMIARID ZONE OF THE USSR (OZERA SEMIARIDNOY ZONY SSSR), Laboratory of Limnology, Leningrad (USSR). For primary bibliographic entry see Field 02H. W72-01403

VEGETATION OF STEPPE LAKES OF NORTHERN KAZAKHSTAN AND ADJACENT AREAS (RASTITEL'NOST' STEPNYKH OZER SEVERNOGO KAZAKHSTANA I SOPREDEL'-

SEVERNUGU KAZAKHSTANA I SOPRED NYKH S NIM TERRITORIY), Laboratory of Limnology, Leningrad (USSR). For primary bibliographic entry see Field 02H. W72-01408

WATER AND ENERGY RELATIONS OF PLANT LEAVES DURING PERIOD OF HEAT STRESS. Missouri Botanical Garden St. Louis; and Washington Univ., St. Louis, Mo. Dept. of Biology. B. MacBryde, R. L. Jeffries, R. Alderfer, and D. M.

Oecologia Plantarum, Vol 6, No 2, p 151-162, 1971. 2 fig, 3 tab, 5 ref.

Descriptors: \*Leaves, \*Cooling, \*Transpiration, \*Convection, \*Energy budget, Heat balance, Heat resistance, Moisture stress, Plant physiology, Sto-mata, Oak trees, Weeds, Shrubs, Corn (Field), Environmental effects, Mode of action, Temperature, Thermal stress, Heat transfer, Osmotic pressure.

The homeostatic mechanisms which facilitate plant adjustment to severe climatic variations are not well understood, particularly since they differ in different plants. The energy and water relations of Plantago lanceolata, P. major (herbs) and Quercus palustris (oak) were studied during a period of environmental stress resulting from a heat storm. The study was then extended to include other species in the area that had also been subjected to the stress conditions. The plantain leaves maintained their temperatures very close to air temperature by means of high transpiration rates. Water deficit caused large changes in the leaf water potential, which quickly resulted in water flow from soil to roots. By contrast, the oak leaves suffered higher temperature rises and exhibited lower transpiration rates. But, convective cooling was significant, particularly in light breezes of 100 cm/sec. Both radiation absorptivity and leaf transpiration resistance were higher in the oak. Additionally, this species possessed a much higher capability for recovery from water stress than did the plaintains. Other spe-cies examined appeared to lack the high efficiency of either the convective or transpirational mechanisms. Shrubs of moderate height are caught between high values of leaf resistance and inadequate convective cooling, and therefore suffered the most damage. (Casey-Arizona) W72-01454

WATER ECONOMY OF CERTAIN NAMIB DESERT ANIMALS, Stellenbosch Univ. (South Africa). Zoological Inst.

G. N. Louw. South African Journal of Science, Vol 67, No 3, p 119-123, March 1971. 5 ref.

Descriptors: \*Xerophilic animals, \*Animal physiology, \*Arid lands, \*Animal behavior, \*Physiological ecology, Reptiles, Mammals, Birds, Hygroscopic water, Urine, Mode of Action, Environmental effects, Habitats, Water shortage, Limiting factors, Microenvironment.
Identifiers: \*Namib Desert, \*Thermoregulation.

Rational exploitation of a desert area requires some knowledge of the ecology of the region and particularly of the water economy of the plants and animals. Of equal importance to biologists is the opportunity for insights into evolutionary adapta-tions to extreme environmental hazards. The most important biological limiting factor in the desert is water. Since thermoregulation is closely associated with the water economy of desert animals, heat load becomes a critical interacting factor with dehydration. Various adaptive strategems are used ranging from behavioral escape to a favorable microclimate by smaller animals to interesting physiological adaptations by larger animals. There is, however, no strict separation between behavioral and physiological adaptations as shown by reviews of 2 small animals, the dassie and the sand diving lizard, and 2 large animals, the ostrich and the oryx. The dassie is able to achieve water economy by possession of fairly high urine concentrating abilities (3,088 millosmoles maximum) and escapes heat by hiding in rock crevices. The sand diving lizard escapes the heat by burrowing into the sand, and probably acquires water by drinking condensed fog. Its extremely distensible stomach allows the storage of an amount of water which can be drawn on for several weeks. The ostrich does not sweat, excretes water-saving uric acid and a concentrated urine, and facilitates cooling by highly specialized feather movements. The oryx does not sweat when under water stress, allows its body temperature to rise as high as 45 degrees C and reduces oxygen consumption. It is seldom a single dramatic factor which allows animals to survive in the desert, but rather a series of small adaptations acting in concert. (Casey-Arizona) W72-01455

LEAF ENLARGEMENT AND METABOLIC RATES IN CORN, SOYBEAN AND SUN-FLOWER AT VARIOUS LEAF WATER POTEN-

Illinois, Univ., Urbana. Dept of Botany.

J. S. Boyer. Plant Physiology, Vol 46, 1970. , p 233-235. 3 fig, 19 ref. OWRR B-036-ILL (2) and A-028-ILL (4).

Descriptors: \*Photosynthesis, \*Respiration, \*Plant growth regulators, \*Moisture stress, \*Soil-water-plant relationships, Corn (Field), Soybeans, Leaves, Inhibition, Limiting factors, Crop production, Consumptive use, Moisture availability, Plant physiology, Metabolism. Identifiers: \*Leaf enlargement, \*Leaf water poten-

tial. Sunflower.

Photosynthesis dark respiration, and leaf enlarge-ment rates were studied in soil-grown corn, soybean, and sunflower plants at various leaf-water potentials to rectify premature or misleading conclusions found in recent literature. Leaf enla ment was inhibited earlier and more severely than photosynthesis or respiration as leaf-water potentials decreased. Leaf-enlargement inhibition was similar in all 3 species under moderate and high enlargement rates, and was large when potentials dropped to minus 4 bars. Graphs show rates of photosynthesis, dark respiration, and leaf enlarge-ment as a function of leaf-water potential. (Popkin-Arizona) W72-01460

BIOLOGICAL LIFE IN WATER,

National Inst. for Water Research, Pretoria (South Africa). For primary bibliographic entry see Field 05C. W72-01473

MICRORELIEF, SOIL WATER REGIME, AND LOBLOLLY PINE GROWTH ON A WET, MOUNDED SITE, Forest Service (USDA), Pineville, La. Southern

Forest Experiment Station

P. L. Lorio, Jr., and J. D. Hodges.

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Soil Science Society of America Proceedings, Vol 35, No 5, p 795-800, September-October 1971. 7, fig, 1 tab, 16 ref.

Descriptors: \*Soil-water-plant \*Loblolly pine trees, \*Louisiana, \*Gulf Coastal Plain, Geomorphology, Infiltration, Soil water movement, Pine trees, Environment, Environmental effects, Disease resistance, Insect resistance.

Microrelief and associated soil characteristics are related to differences in soil water regime and growth response of 40-year-old loblolly pines. Growth on flat sites between mounds about 0.6 m high greatly exceeded that on the mounds, and variability in growth rate was also greater on flats. Soil water recharge from summer or fall showers is related to microrelief and antecedent water status. Recharge on flat sites results in accelerated growth and in zones of earlywood-type cells within the latewood. The soil water regime and tree growth responses indicate an unstable environment on flat sites that probably affects tree rooting and, in time, tree susceptibility to bark beetle attack. (Knapp-W72-01535

#### CULTIVATION OF PLANKTON POPULATIONS (INTERNATIONAL HELGOLAND SYMPOSI-UM, 1969, WEST GERMANY), Bedford Inst., Dartmouth (Nova Scotia).

R. J. Conover.

Helgolaender Wiss Meeresunters. 21 (4): 401-444. Illus. 1970.

Identifiers: Cultivation, Germany, Helgoland, International, Plankton, Populations, Symposium. W72-01590

#### FOOD HABITS OF YOUNG-OF-THE-YEAR STRIPED BASS, ROCCUS SAXATILIS (WAL-BAUM), IN CANTON RESETVOIR. (INVER-TERBRATES), Oklahoma Fishery Research Lab., Norman.

Richado Gomez.

Proc Okla Acad Sci. 50: 79-83, 1970.

Identifiers: Bass, Canton, Food, Habits, Invertebrates, Oklahoma, Reservoir, Roccus-Saxatilis, Striped, Young-of-the-year. W72-01591

#### ASPECTS OF THE OMECHANISM IN PLANTS, COLD HARDINESS

J. Alden, and R. K. Hermann.

Bot Rev. 37 (1): 1971. 37-116. Identifiers: Chemical, Cold, Constituents, Freezing, Growth, Hardiness, Hormones, Injury, Light, Mechanism, Moisture, Photosynthetic, Plants, Protoplasmic, Soil. W72-01606

#### SOME PROBLEMS RELATING TO THE GIANT

TREES, C. B. Bradley.

Amer Forests. 1971: 29-31, 53-56. Identifiers: Ecology, Fire, Giant, Growth, Moisture, Relating, Reproduction, Sequoia-Gigantea-G, Soil,

Trees. W72-01607

#### EFFECT OF THE WIND ON GAS EXCHANGE OF PLANTS.

W. Tranquillini. UMSCH Wiss Tec. 70 (26): 1970. 860-861. Identifiers: Exchange, Gas, Larch-G, Pinus-Cembra-G, Plants, Rhododendron-D, Stomate, Vaporization, Wind. W72-01609

PREDICTIVE VALUE OF FACTORS IN-FLUENCING PERENNIAL GRASS-M PRODUC-TION ON WESTERN WYOMING SAGEBRUSH--D GRASS-M RANGES,

G. L. Whysong.

J Colo Wyo Acad Sci. 7 (1): 1970.36.

Identifiers: Depth, Grass-M, Perennial, Phenological, Precipitation, Predictive, Production, Ranges, Sagebrush-D, Soil, Western, Wyoming. W72-01614

#### HURRICANES AND TREES: 10 LESSONS FROM CAMILLE, P. Touliatos, and E. Roth.

J Forest. 69 (5): 1971. 285-289.

Identifiers: Camille, Chemical, Disease, Hurricanes, Lessons, Mississippi, Pine-G, Resistance, Salvage, Spray, Storage, Techniques, Timber, Trees, Wind. W72-01619

#### EFFECT OF SUPER COOLING AND ICE FOR-MATION DURING FROSTS ON PHOSPHOR-YLATION PROCESSES IN PLANTS,

Z. F. Sycheva, S. N. Drozdov, and V. A. Vasvukova

Sov Plant Physiol. 17 (5): 1970-764.

Identifiers: Chloroplasts, Cooling, Formation, Frosts, Ice, Leaves. Pea-D, Phosphorylation, Photosynthesis, Plar s, Potato-D, Processes, Respiration, Super. W72-01621

#### DROUGHT AND HEAT RESISTANCE OF RIGHT AND LEFT LEAVES OF THE 1ST TIER IN BEANS-D. A HYPOTHESIS ON THE CAUSES OF DIFFERENT OCCURRENCE OF RIGHT LEFT, AND MIXED RIGHT AND LEFT BIOLOGICAL OBJECTS IN NATURE,

Sov Plant Physiol. 17 (5): 1970. 780-786. Identifiers: Beans-D, Biological, Drought, Flowers, Heat, Hypothesis, Leaves, Left, Mixed, Nature, Photosynthesis, Pigments, Resistance, Respiration, St, Tier. W72-01622

#### APPLICATION OF DIELECTRIC SPEC-TROSCOPY TO INVESTIGATION OF THE WATER REGIME OF PLANTS: SOME NEW ASPECTS,

N. V. Sedykh, and N. N. Ishmukhametova. Sov Plant Physiol. 17 (5): 1970. 787-790. Identifiers: Apple-D, Di, Electric, Leaves, New, Water, Wheat-M. W72-01623

#### VALUES OF CELL SAP CONCENTRATION DETERMINED WITH THE AID OF A REFRAC-TOMETER.

L. A. Filippov.

Sov Plant Physiol. 17 (5): 1970. 791-795. Identifiers: Apple-D, Cell, Concentration, Cotton-D, Determined, Leaf, Osmotic, Pressure, Refractometer, Sap, Soil, Suction, Tea-D. W72-01624

#### THE PHYSIOLOGY OF DORMANCY AND SUR-VIVAL OF PLANTS IN DESERT ENVIRON-

D. Koller.

Woolhouse, H. W. (Edited by). Symposia of the Society for Experimental Biology, Number xxiii.

Dormancy and Survival. vi plus 598 p. Illus.

Academic Press, Inc.: New York, N. Y., 1970. 449-

Identifiers: Desert, Dormancy, Environments, Germination, Light, Moisture, Physiology, Plants, Survival, Temperature. W72-01634

#### 2.I. Erosion and Sedimentation

#### STREAMFLOW AND SEDIMENT DEPOSITION

IN THE LOWER COLUMBIA,
California Agricultural Experiment Station,
Berkeley; and Giannini Foundation, Costa Mesa,

Water Resources Research, Vol 7, No 5, p 1199-1207, October 1971. 2 fig, 2 tab, 3 ref.

Descriptors: \*Sedimentation, \*Columbia River, \*Statistical models, \*Channel improvement, \*Dredging, Economics, Cost-benefit analysis, Sediment yield, Sediment transport, Navigation, Water management (Applied), Input-output analysis, Mathematical models, Streamflow. Identifiers: Streamflow-sedimentation relations.

The relationship between the state of the navigation channel and streamflow characteristics was derived by regression analysis on each of the 28 bars in the Columbia River between Vancouver, Washington, and the Pacific Ocean. The regression equations were used to predict dredging costs for three hypothetical streamflow patterns. Dredging costs are quite sensitive to relatively small differences in the magnitude and character of the annual streamflow pattern. (Knapp-USGS) W72-01130

#### CIS AND TRANS LINKS IN NATURAL CHAN-NEL NETWORKS,

IBM Watson Research Center, Yorktown Heights, For primary bibliographic entry see Field 04A. W72-01143

# A SIMPLE PUMPING SAMPLER FOR RESEARCH INTO SUSPENDED SEDIMENT TRANSPORT IN SMALL CATCHMENTS,

Exeter Univ. (England). Dept. of Geography D. E. Walling, and A. Teed. Journal of Hydrology, Vol 13, No 4, p 325-337, September 1971. 5 fig, 11 ref.

Descriptors: \*Sampling, \*Suspended load, \*Storm runoff, Automation, Data collections, Erosion, Sediment yield, Monitoring, Sediment transport. Identifiers: Suspended load samplers.

A simple pumping suspended sediment sampler installed in a small catchment provides useful data on the variations in suspended sediment and dissolved load concentrations during a storm. The factors controlling the levels of suspended sediment concentration in a stream may be determined using these data. When sufficient data are available suspended sediment hydrographs may be used with the usual streamflow hydrographs. A large number of samples can be provided automatically during storms by the pumping samplers. (Knapp-USGS) W72-01148

#### FLOOD DEPOSITS OF THE SAND-BED EPHEMERAL STREAMS OF CENTRAL AUS-TRALIA, Adelaide Univ. (Australia) Dept. of Geology.

George E. Williams.

Sedimentology, Vol 17, No 1-2, p 1-40, September 1971. 17 fig, 3 tab, 23 ref.

Descriptors: \*Channel morphology, \*Alluvial structures, \*Sediment channels, \*Sedimentary structures, \*Sediment transport, \*Sand waves, Ripple marks, Dunes, Sands, Sedimentation, Deposition (Sediments), Stratification, Floods, Flood plains, Arid lands, Statistical methods. Identifiers: Lake Eyre Basin (Australia).

The deposits of sand-bed ephemeral streams in the western Lake Eyre basin,central Australia, were studied after the record floods of February-March

#### Group 2J-Erosion and Sedimentation

1967. Large-scale ripples, the most common bed forms preserved in the majority of channels, covered 30-40% of the depositional area. Other bed forms included longitudinal, transverse and lin-guoid bars, upper-regime plane beds, small-scale ripples, and flute marks. Major bed forms could be related to flood stage: plane beds, large-scale rip-ples, and longitudinal bars usually were generated by high-stage flow, and transverse and linguoid bars by waning and low-stage flow. Trough cross-stratification was produced by migrating small-scale and large-scale ripples. Tabular cross-stratifi-cation resulted from the downstream and lateral growth of channel bars. Flat-bedding with parting lineation was dominant only along the middle reach of the Finke, the major stream in the western Lake Eyre basin. Disturbed bedding was almost totally absent. Bed forms, in order of increasing overall mean grain size of deposits, are plane beds, smallscale ripples, transverse and lingoid bars, and largescale ripples. Sorting and skewness are dependent on mean grain size. Lower-regime flow prevailed for the majority of streams, upper-regime flow being dominant only in the middle reach of the Finke. The greatest mean velocities of flow were about 0.8-3.7 m/sec. (Knapp-USGS)

ELECTRON MICROSCOPY APPLIED TO QUARTZ GRAINS FROM A TROPICAL ENVIRONMENT,

VIKONMENT, Nottingham Univ. (England). Dept. of Geography. J. C. Doornkamp, and D. Krinsley. Sedimentology, Vol 17, No 1-2, p 89-101, Sep-tember 1971. 12 fig, 3 ref.

Descriptors: \*Weathering, \*Quartz, \*Leaching, Expansive soils, Soil formation, Geochemistry, Tropical regions, Wet climates, Soil water, Electron microscopy. Identifiers: \*Uganda.

Chemical weathering was studied by examination, with a scanning electron microscope, of 200 quartz grains from a tropical environment (Uganda). Five main types of features occur: solution pits; solution crevasses; chemical etching along quartz structures; blocky forms probably resulting from swelling; and widespread disintegration of the grain surface. Most of these features, and certainly the combinations noted, have never been observed from any other modern environment; these markings are extremely distinctive to the tropical weathering environment. Thus it should now be possible, assuming that diagenesis has not been too record. (Knapp-USGS)

POSTGLACIAL ALLUVIAL HISTORY IN THE UPPER WHITE-WATER BASIN, SOUTHEAST-ERN INDIANA, AND POSSIBLE REGIONAL RELATIONSHIPS,

Earlham Coll. Richmond, Ind. Dept. of Geology. A. M. Gooding.

American Journal of Science, Vol 271, No 4, p 389-401, November 1971. 2 fig, 16 ref.

Descriptors: \*Sedimentation, \*Alluvial channels, \*Geomorphology, \*Quaternary period, \*Recent epoch, Indiana, Deposition (Sediments), Stratig-raphy, Alluvium, Radioactive dating, Flood plains, Floods, Paleoclimatology, Paleohydrology, Vegetation effects.

Identifiers: Whitewater basin (Ind).

Alluvial geomorphology, soils stratigraphy, and radiocarbon dates on a sub-alluvium organic horizon at one locality in the upper Whitewater basin, southeastern Indiana suggest two cycles of shallow postglacial valley entrenchment and alluviation. The first postglacial entrenchment, completed by 6800 radiocarbon years B.P., established a stable valley bottom that persisted until 1000-radiocarbon years B.P., on which a mat of organic debris accumulated widespread. An episode of alluviation followed, burying the organic debris layer and producing a high bottom alluvial surface presently characterized by shallow soils with a very weak B horizon of clay accumulation. A second stream entrenchment occured in historic time due to increased runoff and flood frequency from deforestation and cultivation. Deposition of alluvial silts with subsidence of floods has produced a slightly lower first bottom surface. Similar posta sugary tower inst bottom surface. Similar post-glacial alluvial geomorphology, soils, and stratigra-phies including a sub-alluvial organic debris layer occur throughout the Ohio River basin and in other upper Mississippi valley drainages. (Knapp-USGS) W72-01153

EROSION -AGGRADATIONAL RELIEF OF THE OLENEK RIVER AND OF THE LEFT BANK OF THE LOWER LENA (EROZIONNO--AKKUMULYATIVNYY RELYEF BASSEYNA OLENEKA I LEVOBEREZH'YA NIZHNEY LENY).

Yu. S. Zhukovskiy.

Izvestiya Vsesoyuznogo Geograficheskogo Obshchestva, Vol 102, No 1, p 10-17, January-February 1970. 1 fig, 2 tab, 8 ref.

Descriptors: \*Geomorphology, \*Topography, \*Valleys, \*Terraces (Geological), Structural geology, River basins, Rivers, Slopes, Flood plains, Erosion, Aggradation, Alluvium, Glaciation, Histo-

Identifiers: \*USSR, Yakutsk ASSR, Olenek River, Lena River, River valleys, Tectonics.

The structure of river valleys of the Olenek River and of the left bank of the lower Lena River was described in terms of their dimensions, slopes, and transverse profiles. New tectonic movements were cited as responsible for the distribution of the entrenchment depths of the river valleys. The lateral shift of the rivers as a result of the daily rotation of the earth (Coriolis acceleration) was believed to be the main force contributing to the preferred development of the steep right slopes of the valleys. The flood plain and 6 flood-plain terraces developed in the river valleys were examined from a morphological and morphometric standpoint. The terraces were subdivided into 3 complexes, depending upon age, height, and degree of preservation. The picture of assimilation of the region by the river network was clarified and established through the distribution of the terrace complexes. The origin of the river systems was largely confined to weak fracture zones and to the boundaries of large structural regions. (Josefson-USGS) W72-01158

SEDIMENT TRANSPORT MEASUREMENTS IN GRAVEL RIVER, Alberta Univ., Edmonton.

A. B. Hollingshead.

A. D. Fromingshead. ASCE Proceedings, Journal of the Hydraulics Divi-sion, Vol 97, No HY 11, Paper 8521, p 1817-1834, November 1971. 13 fig, 3 tab, 12 ref, append.

Descriptors: \*Sediment transport, \*Sediment discharge, \*Discharge measurement, Sediment load, Instrumentation, Equipment, Sampling, Bed load, Suspended load, Alluvial channels, Tracers,

Identifiers: Sediment transport measurement.

Total sediment discharge measurements were carried out on the Elbow River at Bragg Creek, Alberta, Canada, during the summer flood periods of berta, canada, during the summer food periods of 1967-69. Suspended load and bed load were mea-sured directly by sampling. Bed-load was measured by two types of sampler, the VUV (Hungarian type) and Basket type, and the results were com-pared to those obtained by measuring volumetrically the refilling rate of a large pit excavated in the river bed. Sediment-discharge rating curves are used to compare popular bed-load formulas derived from flume measurements to results from a natural gravel-bed river. A practical method is proposed for estimating bed-material discharge, utilizing field observations in conjunction with graphical correlations recently developed from analysis of flume data. (Knapp-USGS)

W72-01164

HYDROLOGY AND EROSION OF LOESSIAL WATERSHEDS, Agricultural Research Service, Columbia, Mo. Soil fracti low i

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and Water Conservation Research Div. For primary bibliographic entry see Field 04D. W72-01165

CHEMICAL AND PHYSICAL CHARAC-TERISTICS OF MESERVE GLACIER MORAINAL SOILS, WRIGHT VALLEY, AN-TARCTICA: AN INDEX OF RELATIVE AGE, Ohio State Univ., Columbus. Inst. of Polar Studies. For primary bibliographic entry see Field 02C. W72-01185

EFFECT OF EROSION-CONTROL SOWING TECHNIQUES ON SOIL EROSION AND MOISTURE, (IN UKRAINIAN), For primary bibliographic entry see Field 04D. W72-01208

PORTABLE RAINFALL SIMULATOR AND PLOT UNIT FOR USE IN FIELD STUDIES OF INFILTRATION, RUNOFF AND EROSION, Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.

For primary bibliographic entry see Field 07B. W72-01237

CONTROL OF SOIL EROSION AND PROTEC-TIVE AFFORESTATION, For primary bibliographic entry see Field 04D. W72-01269

FLOW TILLS AND RELATED DEPOSITS ON SOME VESTSPITSBERGEN GLACIERS, Birmingham Univ. (England). Dept. of Geology. For primary bibliographic entry see Field 02C. W72-01390

COASTAL GEOMORPHOLOGY, MCMURDO

SOUND, ANTARCTICA, Tufts Univ., Medford, Mass. Dept. of Geology. For primary bibliographic entry see Field 02C. W72-01395

BASIC FEATURES IN THE GEOMORPHOLOGY OF BENCHES OF LAKE SHALKAR, KOKCHETAV OBLAST (OSNOVNYYE CHERTY GEOMORFOLOGII BEREGOVYKH VALOV SHALKAR, KOKCHETAVSKAYA OBLAST'),

Laboratory of Limnology, Leningrad (USSR). For primary bibliographic entry see Field 02H. W72-01407

MINERALOGICAL VARIATION LAGOONAL CARBONATES FROM NORTH SOUND, GRAND CAYMAN ISLAND (BRITISH

WEST INDIES), Louisiana State Univ., Baton Rouge, Coastal Stu-

Harry H.Roberts.

Sedimentary Geology, Vol 6, No 3, p 201-213, October 1971. 5 fig, 2 tab, 22 ref.

Descriptors: \*Carbonates, \*Sedimentation, \*Erosion, \*Particle size, Deposition (Sediments), Stratigraphy, Sediment transport, Carbonate rocks, Identifiers: Grand Cayman Island (BWI).

Significant differences in proportions of carbonate minerals exist between environments and size fractions in unconsolidated surface sediments from North Sound, Grany Cayman Island, British West Indies. A consistent carbonate mineral imbalance occurs between the sand-sized and silt/clay-sized

# **Erosion and Sedimentation—Group 2J**

fractions. High-Mg calcite is high and aragonite is low in the fine as compared to the coarse fraction. The magnitude of difference in mineralogical con-tent between size fractions is the same in all four major environmental subdivisions of the sound. The most probable explanation is differential particle size reduction of skeletal grains. This process is cle size reduction of skeletal grains. This process is based toward the least resistant grains, most of which are composed of high-Mg calcite. General covariance of mineralogical behavetistics between fine-and-coarse-sized fractions suggest that the origin of the fines is strongly related to in situ degradation of coarse material. (Knapp-USGS) W72-01416

GROWTH RATES OF VENEZUELAN BEACH

RIDGES, Florida State Univ., Tallahassee, Dept. of Geology.

Sedimentary Geology, Vol 6, No 3, p 215-220, October 1971. 2 fig, 8 ref.

Descriptors: \*Beaches, \*Sedimentation, \*Stratigraphy, Provenance, Sea level, Dunes, Sands, Winds, Surf, Particle size. Identifiers: Beach ridges, Venezuela

Polymodality of sand-size distributions from a roymodanty of sain-size distributions from search ridge plain in western Venezuela permits identification of several examples of the 'surf break' (inflection indicating breaker action) and of a severely limited tail of fines caused by moderately high wave-energy levels. The rate of development of the beach ridge plain decelerated more or less systematically. No materials were suitable for absolute age-dating, and tectonic instability in the area precludes the reliable use of any eustatic sealevel curve. Sand dunes divide the plain into five sub-units representing regular pauses in its development. These are accompanied by significant changes in vertical position, and therefore reflect modifications of either wind regime of sedi-ment supply or both. The youngest strip is normal to the prevailing effective wind, and has a constant width through-out; the most prominent source of sediments was the shallow offshore bottom of the Golfo de Venezuela. (Knapp-USGS) W72-01417

FLOODS OF DECEMBER 1964 AND JANUARY 1965 IN THE FAR WESTERN STATES - PART 1. DESCRIPTION, Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 02E. W72-01430

ISOLATION AND SIZE FRACTIONATION OF MICROPARTICULATE MATTER SUSPENDED IN THE COLUMBIA RIVER,

Batelle Memorial Inst., Richland Wash. Pacific Northwest Labs.

R. E. Wildung, R. C. Routson, and R. L. Schmidt. Northwest Science, Vol. 45, No. 1, p 133-136, August 1971. 1 tab, 6 ref.

Descriptors: \*Suspended load, \*Particle size, \*Clays, \*Centrifugation, \*Sediments, Settling velocity, Filters, Laboratory tests, Columbia River.

Relatively little attention has been directed toward determination of the influence of suspended par-ticulate subdivision on ion sorption from solution, particularly in the clay size range (A2 micra). In order to evaluate the influence of suspended particle size on the behavior of radionuclides and pesticides in the Columbia River, a centrifugation method owas developed for waters of low suspended sediment concentration. The method, which is described, allows size fractionation of suspended particulate matter in the micron and submicron size ranges in quantities sufficient for further studies of isolated fractions, but without harsh chemical treatment. The technique was further tested on samples of Columbia River water taken near Richland, Washington. All particles of diameter greater than 53 micra were filtered out. Of the remaining suspended matter, 60% was less than 2.0 micra in diameter, and as much as 22% was in the less-than 0.5 micra fraction. (Casey-W72-01474

RELATIONS BETWEEN SOIL MORPHOLOGY AND WATER-TABLE LEVELS ON A DIS-SECTED NORTH CAROLINA COASTAL PLAIN

Soil Conservation Service, Raleigh, N. C. For primary bibliographic entry see Field 02G. W72-01532

MONTMORILLONITE EQUILIBRIA AND THE WEATHERING ENVIRONMENT,

Washington State Univ., Pullman. Dept of Agrono-For primary bibliographic entry see Field 02K. W72-01536

STABILITY OF MONTMORILLONITES: II. ABERDEEN MONTMORILLONITE, Washington State Univ., Pullman. Dept. of Agronomy.

For primary bibliographic entry see Field 02K. W72-01537

MAGNESIUM AND SILICON ACTIVITIES IN MATRIX SOLUTIONS OF MONT MORILLONITE-CONTAINING SOILS IN RELATION TO CLAY MINERAL STABILITY, Cornell Univ., Ithaca, N.Y. Dept. of Agronomy. For primary bibliographic entry see Field 02K. W72-01538

INFLUENCE OF TRIBUTARIES ON SEDIMENT INFLUENCE OF TRIBUTARIES ON SEDIMENT COMPOSITION AND DEFORMATIONS OF A MAIN RIVER BED (O VLIYANII PRITOKOV NA SOSTAV NANOSOV I DEFORMATSII RUSLA GLAVNOY REKI), Moscow State Univ. (USSR). Research Lab. of Soil

R. V. Lodina, and R. S. Chalov.

Vestnik Moskovskogo Universiteta, Seriya V, Geografiya, No 4, p 65-70, July-August 1971. 1 fig, 2 tab. 12 ref.

Descriptors: \*Sedimentation, \*Sediments, \*Tributaries, \*River beds, Slopes, Alluvium, Sands, Bed load, Suspended load, Particle size, Backwater, Discharge (Water), Water levels, Floods, Channel erosion, Mineralogy. Identifiers: \*USSR, Amu Darya River, Surkhan Darya River, Lena River, Aldan River, Gradients, Channel deformations, Riffles.

Investigations were conducted in 1966-68 on the Amu Darya River at its confluence with a tributary, the Surkhan Darya, and in 1969 at the confluence of the Lena and Aldan Rivers to examine the influence of tributaries on sediment composition and deformation of main river beds. Movement of coarse material from a tributary into a main river bed alters the gradient of the longitudinal profile and the deformation rate of the river bed. In the case of a confluence of two rivers of the same size, such as the Lena and Aldan, the character of the river bed is influenced by both the spring and summer-fall floods. The phenomenon of variable backwater occurs periodically for the two rivers depending upon the timing of the flood wave in either channel. Sediment deposition is greater in the channel in which backwater is being developed. (Josefson-USGS) W72-01543

CHARACTERISTICS OF SEDIMENT TRANS-PORT IN THE COASTAL ZONE OF LAKE IS-SYK-KUL' (NEKOTORYYE OSOBENNOSTI SYK-KUL' (NEKOTORYYE OSOBENNOSTI PEREMESHCHENIYA NANOSOV V BEREGOVOY ZONE OZERA ISSYK-KUL'), Moscow State Univ. (USSR). Research Lab. of Soil

V. N. Korotayev, and L. G. Nikiforov. Vestnik Moskovskogo Universiteta, Seriya V, Geografiya, No 4, p 71-75, July-August 1971. 2 fig,

Descriptors: "Sedimentation, "Sediments, "Sediment transport, "Geomorphology, \*Lakes, Lake morphology, Lake shores, Banks, Bank erosion, Aggradation, Folds (Geology), Terraces (Geologi-

Identifiers: \*USSR, Kirghiz SSR, Lake Issyk-Kul', Tectonics, Anticlines, Synclines, Uplifts

The morphology of the shores of Lake Issyk-Kul' in the Kirghiz SSR was examined to determine the the Kirghiz SSR was examined to determine the relative importance of longshore and transverse movement of sediments. The transverse movement of sediments was found to be the most important in the formation of aggradational forms in the coastal zone of the lake and was believed to be due primarily to the continuing decline in the lake level, of an average of 7 cm a year. The role of longshore movement of sediments was less important and was limited mainly to the formation of distal terminations of the insular or shore bar. A comparison of the location of the tectonic zones along the lake shores with a map of the shore morphology reveals that in each individual instance the shore bars are confined to the periclinal or limb portions of the anticlinal folds. (Josefson-USGS) W72-01544

FOREIGN INVESTIGATIONS OF RECENT DOLOMITE SEDIMENTS IN MARINE BASINS (ZARUBEZHNYYE ISSLEDOVANIYA SOVREMENNYKH DOLOMITOVYKH OSAD-KOV V MORSKIKH VODOYEMAKH),

Akademiya Nauk SSSR, Moscow. Geologicheskii N M Strakhov

Litologiya i Poleznyye Iskopayemyye, No 4, p 3-28, July-August 1970. 8 fig, 7 tab, 17 ref.

Descriptors: \*Sedimentation, \*Sediments, \*Sedimentary basins (Geological), \*Dolomite, Bodies of water, Lagoons, Reefs, Saline lakes, Sea water, Groundwater, Water chemistry, Carbonates, Calcium carbonate, Magnesium carbonates, Calcite, Anhydrite, Gypsum, Sands, Mud, Diagenesis. Identifiers: "USSR, Australia, Coorong Lagoon, Marine basins, Lake sediments, Intermittent lakes, Facies, Aragonite, Protodolomite, Magnesian

The results of the works of American and Australian lithologists who studied the genesis of dolomite in normally marine and lagoon basins are presented and analyzed. Three facies types of dolomites associated with the sea are established as a result of foreign investigations during the past 12-15 years. These types occur (1) in organogenic sands and muds mainly of the coastal zone below sea level, where they are most often associated with large and small reefs; (2) in the Coorong Lagoon (Southeast Australia) and related intermittent lakes; and (3) on flats of seas in arid regions in the takes; and (3) on rats of seas in and regions in the zone directly above the high-tide level. A new (Soviet) interpretation of the genesis of the dolomite in the Coorong Lagoon, and in the saline lakes which separated from it, accounts for two new aspects of diagenetic dolomite formation: the structure of the alkalinity of the water and the nature of the groundwaters supplying the basin. It is concluded that the cause of dolomite formation in the intermittent lakes separated from the Coorong Lagoon was (1) the metamorphosis of the calcium carbonate lake water under the effect of the inflowing magnesium carbonate groundwater and (2) the interaction of these waters with the lake water hav ing a high pH as a result of the vital activity of plants. Research on the problem of dolomite for-mation in modern basins should include investigations of bodies of water with particular emphasis on their hydrochemistry, including alkalinity, and new studies of dolomite-forming lakes with application of better mineralogical determinations of carbonates in sediments than was possible 30 years ago. (Josefson-USGS) W72-01548

#### Field 02—WATER CYCLE

# **Group 2K - Chemical Processes**

### 2K. Chemical Processes

HYDROGEOCHEMISTRY (GIDROGEOK-HIMIYA), A. M. Ovchinnikov.

Izdatel'stvo 'Nedra', Moscow, 1970. 200 p.

\*Hydrogeology, \*Geochemistry. Descriptors: Descriptors: "Geochemistry, "Hydrogeology, "Groundwater, Water chemistry, Water analysis, Chemical properties, Biochemistry, Petrography, Mineralogy, Rocks, Volcanoes, Metals, Salts, Trace elements, Surface waters, Thermal springs, Mineral water, Water pressure, Mapping, Exploration.

Identifiers: \*USSR, \*Hydrogeochemistry, Aerochemistry, Hydrosphere, Lithosphere, Geosphere, Supergene

Unlike hydrochemistry, which deals with the comof natural surface hydrogeochemistry, as a branch of geochemistry and hydrogeology, is devoted mainly to the study of groundwater. Hydrogeochemistry may be looked upon as a new scientific discipline in which the origin of groundwater and its composition are examined in the light of the dynamic relationships which exist between rock and water. The first two chapters of the monograph provide a brief histori-cal outline of the development of hydrogeochemistry and a hydrogeochemical interpretation of Men-deleyev's Periodic System of Elements. The remaining 7 chapters cover such aspects of the broad field of geochemistry as: (1) chemical com-position of the waters of the earth's crust and position of the waters of the earth's crust and hydrogeochemical zonation of water-pressure systems; (2) modes of migration of the chemical elements in groundwater; (3) hydrogeochemistry of the supergene zone of the earth's crust; (4) hydrogeochemistry of magmatic and hydrothermal exceptions (5) hydrogeochemistry of magmatic and hydrothermal exceptions (6) hydrogeochemistry of hyd processes; (5) hydrogeochemical description of the individual elements and groups of mineral deposits; (6) hydrogeochenical methods of prospecting; and (7) techniques for preparing various-scale hydrogeochemical maps. (Josefson-USGS) W72-00810

DEVELOPMENT AND DISTRIBUTION OF PERMEABILITY IN CARBONATE AQUIFERS,

Geological Survey, Raleigh, N.C. For primary bibliographic entry see Field 02F. W72-01138

ANALYSIS OF ALPINE WATERS BY ION ELECTRODE METHODS,

Dartmouth College, Hanover, N. H. Dept. of Earth Sciences.

Sciences. R. C. Reynolds, Jr. Water Resources Research, Vol 7, No 5, p 1333-1337, October 1971. 3 tab, 3 ref. NSF Grant Gb-6757 AEC Grant At 30-1-3912.

Descriptors: \*Water analysis, \*Glaciers, \*Melt water, \*Electrochemistry, Alpine, Flame photometry, Chemical analysis, Instrumentation. Identifiers: \*lon-sensitive electrodes.

Ion electrode procedures are given for determining S04, Cl, Ca .. Mg, K, and Na for waters of low salinity (less than 30 ppm). Waters derived from glaciers and containing fine rock flour give signifi-cantly higher results for Na and K by atomic ab-sorption methods than by electrode methods. Suspended mineral matter in glacial waters interferes significantly with atomic absorption alkali determinations and for the analysis of such waters, electrode techniques are superior. (Knapp-USGS) W72-01141

CHROMATOGRAPHIC CONCENTRATION OF PESTICIDES FROM A LARGE MASS OF

East Carolina Univ., Greenville, N. C. Dept. of Biology.

For primary bibliographic entry see Field 05A. W72-01330

THE EFFECT OF HERBICIDES, PESTICIDES, AND FERTILIZERS ON THE OPTICAL PROPERTIES OF WATER, Missouri Univ., Kansas City. Dept. of Physics.

For primary bibliographic entry see Field 01B. W72-01334

SECULAR FLUCTUATIONS OF TOTAL MINERALIZATION AND IONIC COMPOSITION OF LAKE WATERS IN THE SEMIARID ZONE VNUTRIVEKOVYYE KOLEBANIYA OBSHCHEY MINERALIZATSII I IONNOGO SOSTAVA VOD OZER SEMIARIDNOY ZONY, Laboratory of Limnology, Leningrad (USSR). For primary bibliographic entry see Field 02H. W72-01405

HYDROCHEMICAL DESCRIPTION OF LAKES IN SEMIARID REGIONS OF THE USSR (GIDROKHIMICHESKAYA TERISTIKA OZER SEMIARIDN
OBLASTEY SSSR),
Laboratory of Limnology, Leningrad (USSR). SEMIARIDNYKH

For primary bibliographic entry see Field 02H. W72-01406

MINERALOGICAL VARIATION LAGOONAL CARBONATES FROM NORTH SOUND, GRAND CAYMAN ISLAND (BRITISH WEST INDIES), Louisiana State Univ., Baton Rouge, Coastal Stu-

For primary bibliographic entry see Field 02J. W72-01416

USE OF ULTRAVIOLET IRRADIATION IN THE DETERMINATION OF NUTRIENTS IN WATER WITH SPECIAL REFERENCE TO NITROGEN, Department of Energy, Mines and Resources, Ot-tawa (Ontario). Inland Water Branch. For primary bibliographic entry see Field 05A. W72-01425

COMPUTER PROGRAMS IN USE IN THE WATER QUALITY DIVISION, VOL. 2,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 07C. W72-01426

C13 AND O18 COMPOSITIONS IN SOME FRESH-WATER CARBONATES ASSOCIATED WITH ULTRAMAFIC ROCKS AND SERPENTINITES: WESTERN UNITED STATES, Geological Survey, Menlo Park, Calif. J. R. O'Neil, and I. Barnes.

Geochimica et Cosmochimica Acts, Vol 35, p 687-697, 1971. 1 fig, 7 tab, 7 ref.

Descriptors: \*Carbonates, \*Streams, \*Carbonate rocks, \*Water chemistry, \*Mineralogy, Water properties, Chemical reactions, Stable isotopes, Hydrogeology, X-ray analysis. Identifiers: \*Ultramafic rocks, \*Serpentinetes, Western U.S. streams.

All carbonates associated with the ultramafic rocks and serpentinites of the western United States are shown by their stable isotope ratios to be of near-surface, low-temperature origin. These include vein materials that have been previously classified as hydrothermal. New laboratory and natural data were obtained on the equilibrium isotope relations between hydromagnesite and water. The origins of travertines in the ultramafic area are easily distinguished on the basis of their stable isotope ratios. The extremely heavy isotope ratios of nesquehonites suggest an intricate evaporating-film mechanism of formation. (See also W72-01523) (Woodard-USGS)

CALCIUM-MAGNESIUM CARBONATE SOLID SOLUTIONS FROM HOLOCENE CON-GLOMERATE CEMENTS AND TRAVERTINES IN THE COAST RANGE OF CALIFORNIA, Geological Survey, Menlo Park, Calif. I. Barnes, and J. R. O TNeil.

Geochimica et Cosmochimica Acta, Vol 35, p 699-718, 1971. 5 fig, 9 tab, 41 ref.

Descriptors: \*Water chemistry, \*Streams, \*California, \*Travertine, \*Water properties, Carbonates, Calcium, Magnesium, X-Ray diffraction, Hydrogeology, Sediments, Dolomite, Stable

Two calcium-magnesium carbonate solid solutions form Holocene travertines and conglomerate ce-ments in fresh water stream channels of the Coast Range of California. The Ca-Mg carbonates form in isotopic equilibrium and thermodynamic dis-equilibrium from dispersion of Ca-rich water into CO3-rich water within the allumium. The stable isotope data suggest that all the Mg-rich carbonates are primary precipitates and not a result of Mg-substitution in precursor CaCO3. There is a correlastitution in precursor CacO3. Inere is a correla-tion between C13 and Mg content of the car-bonates which predicts a 50/00 fractionation of C13 between dolomite and calcite at sedimentary temperatures. C14 is incorporated in Ca-Mg car-bonates forming from C13 poor meteoric waters and C13-rich waters from Cretaceous sediments. C14 ages of the Ca-Mg carbonates are apparent, and cannot be correct to absolute values. Solution rates of calcite decrease with increasing MgCO3 content; dolomite dissolves slower than any calcite. (See also W72-01522) (Woodard-USGS) W72-01523

BENTONITE INSTABILITY AND ITS IN-FLUENCE ON ACTIVATION ENERGY MEA-

SUREMENTS,
Illinois Univ., Urbana. Dept. of Agronomy.
D. S. Brown, and R. J. Miller.
Soil Science Society of America Proceedings, Vol
35, No 5, p 705-710, September-October 1971. 8
fig, 18 ref.

Descriptors: \*Clay minerals, \*Bentonite, \*Hydrolysis, \*Activation energy, Ion exchange, Elec-trolytes, Hysteresis, Water chemistry, Hydrogen ion concentration, Electrochemistry, Free energy.

A time-dependent temperature hysteresis was found in a-c conductance activation energy plots of fresh, neutral, and slat-free Na-bentonite sions. This phenomenon is caused by chemical in-stability of the bentonite lattice promoted by hydrolysis of exchangeable cations, resulting in the release of octahedral cations, and breakdown and dissolution of the silica lattice. The hydrolysis is effectively suppressed by free salts. (Knapp-USGS) W72-01530

ILLITE SOLUBILITY,

Washington State Univ., Pullman. Dept. of Soil R. C. Routson, and J. A. Kittrick.

Soil Science Society of America Proceedings, Vol 35, No 5, p 714-718, September-October 1971. 1 fig, 1 tab, 21 ref. Grant 16060 DGK (FWOA) Con-tract AT (45-1)-1830 (NSAEC).

Descriptors: \*Solubility, \*Free energy, \*Illite, Clay minerals, Weathering, Hydrolysis, Soil formation, Water chemistry, Solutes, Electrolytes, Acidity, Aqueous solutions, Laboratory tests.

Equilibrium solubilities of the 0.2-2.0 micron size fraction of three K-saturated illites were determined in high-pH aqueous solutions. Logarithms (base 10) of the solubility products were -77.6 plus or minus 0.1 for Beavers Bend illite, -76.6 plus or minus 0.3 for Fithian illite, and -76.7 plus or minus 0.2 for Goose Lake illite. From the solubility product and known thermodynamic relationships, the standard free energies of formation were - 1267.6 plus or minus 0.9 for Beavers Bend, -1270.6

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W72-01522

plus or minus 1.0 for Fithian, and -1265.3 plus or minus 1.0 kcal/gram formula weight for Goose Lake illites. (Knapp-USGS) W72-01531

MONTMORILLONITE EQUILIBRIA AND THE WEATHERING ENVIRONMENT, Washington State Univ., Pullman. Dept of Agrono-

my. J. A. Kittrick.

Soil Science Society of America Proceedings, Vol 35, No 5, p 815-820, September-October 1971. 4 fig, 1 tab, 11 ref. FWPCA Grant 16060 DGK.

Descriptors: \*Montmorillonite, \*Clay minerals, \*Weathering, \*Ion exchange, \*Water chemistry, Mineralogy, Crystal growth, Equilibrium, Aqueous solutions, Hydrogen ion concentration, Magnesi-um, Silica, Aluminum, Iron, Free energy.

Equilibria for two montmorillonites agreed with istability equations that depended upon structural ions and cation-exchange capacity, but not upon the exchangeable ions. Stability diagrams for a series of soil solution compositions suggest that the various montmorillonite compositions encountered in nature are primarily a reflection of disease of in nature are primarily a reflection of diverse solution environments, rather than of chance incorporation of ions during the crystal growth process. (See also W72-01537) (Knapp-USGS) W72-01536

STABILITY OF MONTMORILLONITES: II. ABERDEEN MONTMORILLONITE, Washington State Univ., Pullman. Dept. of

Agronomy. J. A. Kittrick.

Soil Science Society of America Proceedings, Vol 35, No 5, p 820-823, September-October 1971. 1 fig, 2 tab, 12 ref. FWPCA Grant 16060 DGK.

Descriptors: \*Montmorillonite, \*Clay minerals, \*Weathering, \*Ion exchange, \*Water chemistry, Mineralogy, Crystal growth, Equilibrium, Aqueous solutions, Hydrogen ion concentration, Magnesi-um, Silica, Aluminum, Iron, Free energy.

Six montmorillonite samples from Aberdeen, Mississippi were equilibrated with various solutions for 3-4 years. Aberdeen montmorillonite was found to be less stable than Belle Fourche montmorillonite and kaolinite. Locating the Aberdeen solubility line where it is metastable was difficult because of the tendency of the samples to approach the nearest stable solubility line. Two of the six samples resided at the matastability line briefly before approaching the more stable kaolinite solubility line. The resulting three points were in close agreement with the calculated slope and intercept of the montmoril-lonite solubility line as derived from the unit cell formula of Aberdeen montmorillonite. A free energy of -2450.3 plus or minus 0.1 kcal per mole was based upon the assumption that Fe in solution was controlled by hematite. (See also W72-01536) (Knapp-USGS) W72-01537

MAGNESIUM AND SILICON ACTIVITIES IN MATRIX SOLUTIONS OF MONT MORIL-LONITE-CONTAINING SOILS IN RELATION TO CLAY MINERAL STABILITY, Cornell Univ., Ithaca, N.Y. Dept. of Agronomy. R. M. Weaver, M. L. Jackson, and J. K. Syers.

Soil Science Society of America Proceedings, Vol 35, No 5, p 823-830, September-October 1971. 6 fig. 4 tab, 36 ref. NSF Grants GP4144 and GA1108.

Descriptors: \*Clay minerals, \*Weathering, \*Soil formation, \*Montmorillonite, \*Kaolinite, Equilibrium, Ion exchange, Hydrogen ion concentration, Aqueous solutions, Water chemistry, Mag-

Soils of varying geomorphological site characteristics were sampled in the southern Wisconsin

catena for the preparation of soil matrix solutions used for solute activity determinations. The clays in the samples contained from 27 to 45% of montmorillonite and from 11 to 3% of kaolinite. The solute activity functions for the field-fresh soil matrix solutions fell distinctly into areas indicative of either montmorillonite stability (poorly drained or calcareous horizons) or of kaolinite stability (moderately well-to well-drained, acid horizons) in a phase stability diagram developed to include a Mg-saturated montmorillonite phase. The solute activity functions for montmorillonite-free soils from northern Indiana, for montmorillonites of bentonites, and for kaolinites and chlorite also showed these relationships. (Knapp-USGS) W72-01538

EFFECT OF SOIL MOISTURE TENSION ON NITRATE ACCUMULATION IN DRUMMER SILTY CLAY LOAM,

Illinois Univ., Urbana. Dept. of Agronomy. For primary bibliographic entry see Field 02G. W72-01541

THE DETERMINATION OF MERCURY IN SOILS BY FLAMELESS ATOMIC ABSORP-TION,

Texas A and M Univ., College Station. Dept. of Agricultural Analytical Services. For primary bibliographic entry see Field 05A. W72-01542

GEOCHEMICAL RANGES OF TITANIUM MIGRATION IN GROUNDWATER (O GEOK-HIMICHESKIKH DIAPAZONAKH MIGRATSII

TITANA V PODZEMNYKH VODAKH), All-Union Scientific Research Inst. of Hydrogeolo-gy and Engineering Geology, Moscow (USSR). S. R. Kraynov, I. V. Baturinskaya, and V. M. Zharikova.

Litologiya i Poleznyye Iskopayemyye, No 4, p 132-139, July-August 1970. 2 fig, 4 tab, 17 ref.

Descriptors: \*Geochemistry, \*Titanium, \*Ground-water, \*Water types, Acidic water, Alkaline water, Water analysis, Chemical analysis, Hydrolysis, Neutralization, Hydrogen ion concentration, Fluorine, Organic matter. Identifiers: \*USSR, Kola Peninsula, Ural Moun-laine Hydrogene hierts. Supergrapais: Alkaline

tains, Hydrogeochemistry, Supergenesis, Alkaline

rocks, Water migration.

Field and experimental hydrogeochemical investigations were conducted in areas of alkaline rock complexes on the Kola Peninsula and in the study the geochemistry of titanium in acidic, alkaline and nearly neutral waters. Titanium is not only a hydrolysate element but a complexformer as well; hence, the region of water migra-tion of titanium is not limited to acidic media. Under the natural conditions of a supergene zone there are two types of hydrogeochemical media in which an intensification of titanium migration occurs: acidic and alkaline. Intensification of titanium migration in alkaline waters is caused by the formation of complexes with inorganic addends concentrated in these waters (primarily with fluorine). Organic substances are of the greatest importance for the migration of small titanium concentrations (0-10 micrograms/liter). The minimum migration capacity of titanium is typical of nearly neutral media, which are characterized by minimum con-centrations of inorganic addends. (Josefson-USGS) W72-01547

#### 2L. Estuaries

CLEAN WATER FOR GEORGIA'S ESTUARIES. For primary bibliographic entry see Field 05G. W72-01056

CLEAN WATER FOR VIRGIN ISLANDS' ESTUARIES. For primary bibliographic entry see Field 05G.

W72-01057

ESTUARY WATER TEMPERATURE SEN-SITIVITY TO METEOROLOGIC CONDITIONS, Water Resources Engineers, Inc., Springfield, Va. G. K. Young, M. T. Tseng, and R. S. Taylor. Water Resources Research, Vol 7, No 5, p 1173-1181, October 1971. 7 fig. 1 tab, 4 ref.

Descriptors: \*Estuaries, \*Water temperature, \*Mathematical models, Simulation analysis, Tidal effects, Streamflow, Humidity, Solar radiation, Florida, Meteorology, Meteorological data, Ther-Identifiers: Miami (Fla).

The time history of water temperature in an estuary may be determined by using a thermal quality model in conjunction with a hydrodynamic simula-tion model. The hydrodynamic model computes tion model. The hydrodynamic model computes tidal stages and flows throughout the estuary for any tidal cycle. The thermal quality model uses the results of the hydrodynamic model and observed meteorologic data to predict water temperatures. These models have been used successfully in case studies to reproduce observed water temperatures. The sensitivity of the resulting temperatures to the various meteorologic parameters, such as wind conditions, dew point temperature, and solar radiation, is discussed. Dew point temperature exerts a major influence on water temperature. (Knapp-USGS) W72-01127

FACTORS CONTROLLING THE SUPPLY AND THE CHEMICAL COMPOSITION OF AEROSOLS IN A NEAR-SHORE AND COASTAL ENVIRONMENT, Hebrew Univ., Jerusalem (Israel). Dept. of Geolo-

gy. For primary bibliographic entry see Field 05B. W72-01194

SOME FACTORS AFFECTING THE DISTRIBU-TION OF ORCHESTIA LEACH IN ESTUARIES, Fisheries Research Board of Canada, St. Andrews New Brunswick). For primary bibliographic entry see Field 05C. W72-01197

MARINE FISHES OF VIRGINIA'S EASTERN SHORE (INLET AND MARSH, SEASIDE WATERS),

Virginia Inst. of Marine Science, Gloucester Point. ruginia inst. of Marine Science, Gloucester Point. C. E. Richards, and M. Castagna. Chesapeake Sci. 11 (4): 235-248. Map. 1970. Identifiers: Checklist, Distribution, Eastern, Fishes, Inlet, Marine, Marsh, Menidia-Menidia, Seaside, Shore, Virginias, Waters.

A small trawl and beach seine survey was made, June 1965-July 1966, of marine fishes inhabiting 27 selected stations in seaside waters of Virginia's Eastern Shore. Seventy spp. were collected, 47 by trawl and 52 by seine. Eleven spp. are considered resident. Ten spp. made up 97.8% of the total number collected with Menidia menidia being the most abundant. A checklist of 96 spp. known to inmost abundant. A check list of 96 spp. Rhown to inhabit the area is given with hydrographic and distribution details for each species when known. Species assemblages by seasons for inlet, midchannel, inshore beaches, and tital creeks are also given in tabular form. —Copyright 1971, Biological Abstract. stracts. Inc. W72-01202

OCCURRENCE OF THE COMMON SNOOK, CENTROPOMUS UNDECIMALIS (BLOCH) (PISCES-CENTROPOMIDAE), IN NORTH CAROLINA WATERS,

CAROLINA WATERS, Virginia Inst. of Marine Science, Gloucester Point. J. V. Merriner, W. T. Hogarth, and W. A. Foster. J Elisha Mitchell Sci Soc. 86 (4): 194-195. 1970. Identifiers: Centropomidae, Centropomus-Un-decimalis, Distribution, North Carolina, Pisces, Seasonal, Snook.

#### Field 02-WATER CYCLE

#### **Group 2L—Estuaries**

Two spatially and temporally distinct captures of juvenile C undecimalis, the common snook, from Bogue Sound (2 specimens-1966) and Pamlico Sound (3 specimens-1969), North Carolina are reported. Snook are considered voluntary immigrants or water current transports to our waters and not or water current transports to our waters and not progeny from a local spawning population, since winter water temperatures below 40F. are common and the stated minimum safe survival temperature is 60F. for Florida snook. Further studies of the distribution and seasonal appearance of snook are underway.—Copyright 1971, Biological Abstracts,

W72-01203

BENTHIC BIOCENOSES AND RESERVES OF ZOOBENTHOS IN THE TAGANROG BAY OF THE SEA OF AZOV, (IN RUSSIAN), Azovskii Nauchno-Issledovatelskii Institut Ryb-

nogo Khozyaistva, Rostov-na-Donu (USSR). M. Y. Nekrasova.

Gidrobiol Zh. 6 (1): 74-78. Illus. 1970.

Identifiers: Azov, Bay, Benthic, Benthos, Biocenoses, Fishery, Reserves, Sea, Taganrog, USSR. Zoo

Structure and relationship of the different zoobenthic organisms of Taganrog Bay and their importance to the fishery of the area are discussed. -Copyright 1971, Biological Abstracts, Inc. W72-01265

OCCURRENCE OF TOXIC BIVALVE MOL-LUSCS DURING A GYMNODINIUM BREVE

Gull Coast Water Hygiene Lab., Dauphin Island,

For primary bibliographic entry see Field 05C. W72-01295

NEW DATA ON PATTERNS OF THE FORMA TION OF HYDROLOGICAL AND HYDROCHEMICAL CONDITIONS IN THE BALTIC SEA BASIN AND ON THE PRODUCTIVITY OF ITS WATERS, (IN RUSSIAN),

A. E. Antonov. Tr Balt Nauch-Issled Inst Ryb Khoz. 4: 5-18. 1970. Identifiers: Baltic, Basin, Fishery, Formation, Gasses, Hydrochemical, Hydrological, Patterns, Productivity, Salts, Sea.

The variations in the productivity of the waters of the open portion of the Baltic Sea are caused, chiefly, not by the influx of biogenic salts from the land, but by their redistribution in the layers of water of the sea under the influence of the inflow of waters from the North Sea. The principal traits of the changes in the water conditions take form in the area of the Kattegat and the straits under the action of planetary, cosmic, and other forces which act on the hydrosphere through processes of atmospheric circulation. The changes which occur reach the Landsort and Gothland deeps in about 3 yr. The shaping of permanent tendencies in the development of conditions in the Baltic begins in the bottom and deep waters; these changes develop first in the conditions of the dissolved gases and biogenic salts, and then in those of thermal relations and salinity. This is followed by changes in the phosphate concentration of the surface waters, and the effect on theproductivity of generations of fish closes the natural cyclic process. The productivity of the waters consequently changes with a falloff toward the east. This outline facilitates the composition of highly effective hydrological and hydrochemical prognoses and a basis for constructing highly complex oceanological prognoses applicable to fisheries problems.—Copyright 1971, Biological Abstracts, Inc. W72-01305

ASSIMILATION OF DETRITUS AND ITS AS-SOCIATED BACTERIA BY THREE SPECIES OF ESTUARINE ANIMALS, Zool. Dep., N.C. State Univ., Raleigh, N.C. North

Carolina State Univ., Raleigh. Dept. of Zoology. For primary bibliographic entry see Field 05C.

W72-01316

PHYTOPLANKTON SPECIES AND POPULA-TIONS IN THE PAMLICO RIVER ESTUARY OF NORTH CAROLINA, North Carolina State Univ., Raleigh. Dept. of

Zoology. For primary bibliographic entry see Field 05C. W72-01329

ENVIRONMENTAL QUALITY: THE WET-LANDS OF THE CHESAPEAKE BAY MUST BE

PROTECTED, Senate, Washington, D.C. For primary bibliographic entry see Field 06E. W72-01344

SEA-WATER INTRUSION: AQUITARDS IN THE COASTAL GROUND WATER BASIN OF OXNARD PLAIN, VENTURA COUNTY. California State Dept. of Water Resources, Sacra mento

For primary bibliographic entry see Field 02F. W72-01376

OBSERVATIONS OF SOIL EVAPORATION OBSERVATIONS OF SOIL EVAPORATION
AND PLANT TRANSPIRATION IN AN ESTUARY IN WEST KAZAKHSTAN (NABLYUDENIYA
NAD ISPARENIYEM S POCHVY I TRANSPIRATSIYEY RASTITEL'NOSTI LIMANA V
ZAPADNO-KAZAKHSTANSKOY OBLASTI),
Laboratory of Limnology, Leningrad (USSR).
For primary bibliographic entry see Field 02H.
W72-01413

A BILL TO ESTABLISH A NATIONAL POLICY AND DEVELOP A NATIONAL PROGRAM FOR THE MANAGEMENT, BENEFICIAL USE, PROTECTION, AND DEVELOPMENT OF THE LAND AND WATER RESOURCES OF THE NATION'S COASTAL AND ESTUARINE ZONES. For primary bibliographic entry see Field 06E. W72-01650

CLEAN WATERS FOR ALABAMA'S ESTUA-

For primary bibliographic entry see Field 05G. W72-01666

### 03. WATER SUPPLY AUGMENTATION AND CONSERVATION

### 3A. Saline Water Conversion

THE FEASIBILITY OF SITING ON 8 MGD VAPOR COMPRESSION DISTILLATION DESALTING PLANT AT BROWNSVILLE, TEX-

Fluor Corp. Ltd; Los Angeles, Calif. R. W. Newkirk, and M. E. Marwede.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402 Price \$2.25. Office of Saline Water Research and Development Progress Report No 691, December 1970. 71 p, 12 fig, 11 tab. 14-01-0001-2582.

Descriptors: \*Desalination plants, \*Economic feasibility, \*Water costs, Sea water, \*Distillation, Sites, Construction costs, \*Operating costs, Texas. Identifiers: Brownsville (Texas), \*Brine Disposal.

The type of plant selected for examination of site Ine type of plant selected for examination of site feasibility and construction and operating cost is the vapor compression, vertical tube, multi-stage flash (VC-VTE-MSF) distillation plant arrangemen. now under development by the Office of Saline Water. The results of the study reveal that it foreights to be results of the study reveal that it is feasible to locate such a plant on the Ship Chan-nel at its terminus nearest the city and dispose of

the brine wastewater from the plant to nearby tidal flats without adverse environmental effects. The flats without adverse environmental effects. The estimated cost of construction is \$9,730,000 and the estimated cost of distilled water production is 53 cents per 1000 gallons, based on the assumption of 30-year plant life and straight-line depreciation at a 7.3% capital recovery factor, 90% piant factor, and the utilization of natural gas valued at 30 cents per million Btu as the heat source for driving the process. (OSW-Abstract) W72-01481

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TEST OF 10,000 GPD REVERSE OSMOSIS (SPIRAL MODULE) PILOT PLANT SAN DIEGO, CALIFORNIA, Gulf General Atomic, Inc., San Diego, Calif,

R. G. Sudak.
Office of Saline Water Research and Development

Progress Report No 453, 1969. 39 p, 7 fig, 10 tab, 3 ref. OSW Contract 14-01-0001-1264.

Descriptors: \*Water desalting, \*Water purifica-tion, \*Water treatment, \*Desalination processes, \*Membrane processes, \*Reverse osmosis, \*Pilot plants, \*Treatment facilities, \*Desalination, California, Brackish water. Identifiers: \*Spiral module, \*San Diego (Califor-

nia), \*Sodium Hexametaphosphate

The test was conducted in the Mission Valley area of San Diego, California on a 4,460 ppm TDS brackish well water. This water contained high concentrations of total dissolved solids, hardness, alkalinity, and iron and manganese. Using a 3-ft. spiral module containing a nominal 28 sq. ft. of spiral module containing a nominal 25 sq. it. of membrane and a tricot weave dacron reinforced with melamire resin backing material, long term endurance testing was initiated in December 1967 and terminated in May 1968. During this time, the pilot plant operated for 3,020 hours, provided a constant salt rejection of 97.8%, and experienced a constant salt rejection of 97.8%, and experienced a constant salt rejection of 97.8%, and experienced a flux decline from 11.8 to 10.3 gfd. Parametric variation testing involving pressure, recovery ratios, feedwater composition, pH, temperature and feedwater pretreatment was conducted. Pressure variations from 600 to 800 psig increased the product flow by 30%; product water quality remained below 500 ppm TDS throughout the 60 to 80% recovery ratio variation test. At a pH of 7 and 15% recovery ratio calcium carbonate scaling and 75% recovery ratio, calcium carbonate scaling occurred. Between 72 to 82F, the product water flow showed a 1.4% increase for each degree Fahrenheit rise in the feedwater temperature. (OSW-Abstract) W72-01482

BOILLING HEAT TRANSFER IN FALLING FILM EVAPORATORS WITH CORRUGATED

Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs. G. Jansen, and P. C. Owzarski.

Grainsen, and F. C. Owzarski.
For sale by Superintendent of Documents, U. S.
Government Printing Office, Washington, D. C.
20402 Price \$0.75. Office of Saline Water
Research and Development Progress Report No
693, Sept 1971. 50 p, 31 fig, 1 tab, 10 ref, 2 append. OSW Contract 14-01-0001-1168.

Descriptors: \*Desalination, \*Heat transfer, \*Evaporation, \*Boiling, Mathematical models,

Surface tension.
Identifiers: \*Boiling heat transfer coefficients.
\*Falling film evaporation, Corrugated surfaces.

Boiling heat transfer coefficients were determined for falling film evaporation on corrugated surfaces. The coefficients based on a true surface area were in the range 700 to 4500 and 3000 to 10,000 Btu/ (hr) (F) (ft2) for deionized and saline water, respectively. The local coefficients varied much respectively. The local coefficients varied much more from peak to valley with deionized water than with saline water, probably because of poorer wetting by deionized water and an apparent difference in boiling modes. Increased heat input to the peaks resulted in higher overall heat transfer coefficients for deionized water. The results are ex-

#### WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

#### Use of Water of Impaired Quality—Group 3C

plained qualitatively by models with intense local planter quantatively by models with intense local recirculation driven by surface tension forces de-pendent on concentration gradients for saline water and temperature gradients for deionized water. (OSW-Abstract)

ANNUAL REPORT (FY 70) WEBSTER TEST FACILITY AND ELECTRODIALYSIS T BED PLANT, WEBSTER, SOUTH DAKOTA,

Mason-Rust, Louisville, Ky. R. A. Ackerman, J. E. Nordin, and D. Bogue. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402 price \$1.75. Office of Saline Water Research and Development Progress Report No 692, June 1971. 167 p, 31 fig, 19 tab. OSW Contract 14-01-0001-2263.

Descriptors: \*Brackish water, \*Desalination, \*Electrodialysis, South Dakota, Hardness, Time, Calcium carbonate.

Identifiers: Webster (South Dakota), Test bed

This report presents the Test Bed Plant Maintenance and Operational history and the Experimental Program as carried out during rhe period 1 July 1969 through 30 June 1970. The least costly mode of Test Bed Plant operation is to add lime such that calcium bicarbonate hardness will be removed. The chemical cost of lime addition will be \$0.032 per 1,000 gallons of ED product or \$0.025 per 1,000 gallons of well water to be treated. If more lime and soda ash is added, further hardness reduction will be achieved; however, the chemical cost will be much higher, up to \$0.245 per 1,000 gallons of electrodialysis product. Pro-jected feed water requirements for a 250,000 GPD plant will be 281,000 GPD for total hardness reduction and 316,000 GPD for calcium bicarbonate hardness reduction. The probability of pH upsets in the lime softening pretreatment plant is increased as more and more hardness is removed. If less than the calcium bicarbonate hardness is removed, then lime costs would be less. However, the TDS reduction would not be as great, resulting in higher electrodialysis costs through the use of more membranes, or an additional stage, or in-creased current and increased dilution stream linear velocity. Such modifications would probably cost more than the \$0.032 per 1,000 gallons slated for lime costs (amortization of a single ED stack increased product water \$0.06 to \$0.08 for example). In addition, gross underfeeding of lime may result in iron and manganese carryover. (OSW-Abstract) W72-01485

CHLOROMET-ON SITE GENERATION OF HYPOCHLORITE,

Ionics Inc., Watertown, Mass. For primary bibliographic entry see Field 05D. W72-01506

#### 3B. Water Yield Improvement

COMPARISON OF TWO FIELD TECHNIQUES FOR DETERMINATION OF WATER POTENTIAL IN TWO HALOPHYTES,

Urbana Coll., Ohio. For primary bibliographic entry see Field 07B. W72-01308

COMPARATIVE ECOLOGY OF MONTANE AND DESERT REPROSOS (CATTLE WATER-ING-IMPOUNDMENTS) IN SOUTHERN NEW,

New Mexico State Univ., IUniversity Park. Dept. of

Biology. For primary bibliographic entry see Field 021. W72-01340

CHANGES IN WATER YIELD FOLLOWING PARTIAL FOREST COVER REMOVAL ON AN EXPERIMENTAL WATERSHED, Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.

W. E. Sopper, and J. A. Lynch.
Pennsylvania State University Institute for
Research on Land and Water Resources Reprint
Series No 21, p 369-389, 1970 (Reprint from International Association of Scientific Hydrology Publication No 96). 11 fig, 7 tab, 5 ref. OWRR A-006-PA (12).

Descriptors: \*Clear-cutting, \*Water yield, \*Water yield improvement, \*Sediment yield, Watershed management, Water management (Applied), Rainfall-runoff relationships, Water temperature, Runoff, Erosion, Pennsylvania.

Partial removal of the vegetative cover on a forested, experimental watershed in central Pennsylvania resulted in significant increases in water yield. Careful logging, following recommended watershed management practices, caused little disturbance of the soil surface and, hence, had only a minor effect on water turbidity. Only 8 of 23 turbidity samples collected during logging exceeded 25 ppm. Of these 8, 5 were storm samples. Maximum non-storm and storm turbidity measured during logging was 175 and 550 ppm, respectively, on the treated watershed, while the control watershed never exceeded 10 ppm. Treatment resulted in a significant increase in annual water resulted in a significant increase in annual water yield of 2.74 inches during the first year following logging. Most of this increase, 2.34 inches, occurred during the growing season, particularly in July, August, and September. The partial clear-cutting had a variable effect on instantaneous peak flows above 10 cubic feet per second per square mile. Significant increases in maximum peaks of approximately 50% were observed for 8 out of 20 storms. Treatment also had a major effect on low flows. The days per year of low flows, flows below 0.1 cfs/sq m, decreased from an average of 158 days during the pretreatment period to a predicted value of 65 days the first year following completion of logging, (Knapp-USGS)
W72-01414

HYDROLOGIC REGIME OF LAKE HERTEL,

McGill Univ., Montreal (Quebec). Dept. of Civil Engineering. For primary bibliographic entry see Field 02H. W72-01418

GROUNDWATER RESOURCES OF MONT-GOMERY COUNTY, TEXAS,

Geological Survey, Austin, Tex. For primary bibliographic entry see Field 04B. W72-01427

GROUNDWATER RESOURCES OF RENVILLE AND WARD COUNTIES,

Geological Survey, Bismarck, N. Dak. For primary bibliographic entry see Field 02F. W72-01431

VEGETATION CONVERSION AND CHANNEL GEOMETRY IN MONROE CANYON, SOUTHERN CALIFORNIA, California Univ., Los Angeles. Dept of Geography; and Forest Service (USDA), South Lake Tahoe,

Calif

For primary bibliographic entry see Field 04C. W72-01451

UNIVERSITY CREATES DESERT FARM AS MODEL FOR WORLD'S ARID AREAS, 21NEWS FROM THE HEBREW UNIVERSITY OF JERUSALEM, NO. 5-6, MAY-JUNE 1971, P. 1-

-14, 2 FIG. Hebrew Univ. Jerusalem (Israel). Dept. of Informa-

tion and Public Affairs.
For primary bibliographic entry see Field 03F.
W72-01461

THE WATER PROJECTS OF THE NAMIB

DESERT, South-West Africa. Dept. of Water Affairs.

South African Journal of Science, Vol. 67, No. 3, p. 152-158, March 1971. 1 fig.

Descriptors: \*Arid lands, \*Dunes, \*Water resources development, \*Water supply, Water yield, Water delivery, Water harvesting, Water resources, Geomorphology, Dune succession, Deserts, Foreign countries, Rivers, Wells, Tourism, Mining, Resignal analysis Geographical serious Mining, Regional analysis, Geographical regions, Hydroelectric power. Identifiers: \*Namib Desert, \*South West Africa,

\*Oases, \*Tube wells.

The Namib Desert is one of the true deserts of the world, with average rainfall varying over 0-100 world, with average rainfall varying over 0-100 mm. During previous geological eras, rivers debouching from the interior formed extensive deltas, and later, prevailing southerly winds, carrying coastal beach sands, formed the coastal dune belt. Weak rivers are completely swallowed by the dunes. Water development in the Namib has required extreme ingenuity. Starting from the Orange River in the south and proceeding to the Cunen River on the Angolan border, the various water projects on the Namib are described. The projects include sea water distillation, exploitation of natural oases, tube wells in the dunes, and development of large water supplies beneath the desert sands. These water projects will eventually support modern towns, industies and mineral exploitation, but will not yield enough water for ploitation, but will not yield enough water for agricultural development. Such projects must be carefully planned to ensure minimal disturbance of the natural desert environment because of its tourism potentialities. (Casey-Arizona) W72-01475

# 3C. Use of Water of Impaired Quality

DISTRIBUTION OF SOLUBLE SALTS AND BORON IN SOILS IN RELATION TO IRRIGA-

TION WATER, Udaipur Univ. (India). B. L. Jain, and S. N. Saxena. J Indian Soc Soil Sci. 18 (2): 175-182 1970. Identifiers: Boron, Distribution, Irrigation, Relation, Salinity, Salts, Soils, Soluble.

Irrigation waters of Udaipur region are medium to high in salinity and Na and low in B. Salinity in irrigation water has contributed to salinity of the soils. For the same quality of irrigation water, salinization is more in heavy soils as compared to that in the light soil. High Na in irrigation water has caused sodiumization of the soil and in a few cases Na has accumulated at lower depth. B, though comparatively lower in content in irrigation water, is present in higher amounts in the soil. B and Na has increased simultaneously in the soils.—Copy-right 1971, Biological Abstracts, Inc. W72-01232

CHARACTERISTICS OF CERTAIN SOILS IN THE LEFT-BANK SECTION OF THE BUK-HARA OASIS (IN RUSSIAN),

A. T. Niyazov. Nauch Tr Tashkent Univ. 325. 3-10, 1968. Identifiers: Bukhara, Humus, Irrigation, Left-Bank, Mineral, Oasis, Salinity, Section, Soils, USSR.

The following 3 soil types were identified in the area: irrigated meadow and alluvial deserts, bogmeadow alluvial soils, and meadow alluvial solochaks. The 1st type is further classified into long-irrigated, newly irrigated and newly cultivated soils, and also according to the thickness of their humans horizons. The soils are mainly (73.8%) numans nortzons. The souls are manny (3.5%) saline. Through centuries of irrigation, oasis soils developed the 'agro-irrigation' horizon which has appreciably altered its surface relief. The muck deposited by irrigation water increased the clay fraction in the upper part of soil profile and the hu-

# Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION Group 3C-Use of Water of Impaired Quality

mus, P and K contents .-- Copyright 1971, Biological Abstracts, Inc. W72-01240

# 3D. Conservation in Domestic and **Municipal Use**

METHODOLOGY TO EVALUATE SOCIO-ECONOMIC BENEFITS OF URBAN WATER

Berger (Louis) Inc., East Orange, N.Y. For primary bibliographic entry see Field 06B. W72-01343

REDUCTION OF URBAN RUNOFF PEAK FLOWS BY PONDING, Rice (Leonard) Consulting Water Engineers,

For primary bibliographic entry see Field 04A. W72-01421

WATER AS A POTENTIAL ORGANIZING CON-CEPT IN URBAN REGIONS, 10J. SHEAFFER, Chicago University, Ill. Center for Urban Studies. For primary bibliographic entry see Field 06B. W72-01488

SOLVING MAJOR URBAN PROBLEMS, Chicago Dept. of Public Works, Ill. For primary bibliographic entry see Field 06B. W72-01562

MEASURING IMPACTS OF URBAN WATER

DEVELOPMENT,
Battelle Memorial Inst., Columbus, Ohio For primary bibliographic entry see Field 06B. W72-01564

EFFICIENT MANAGEMENT POLICIES FOR URBAN WATER SUPPLY,

Cornell Univ., Ithaca, N. Y. For primary bibliographic entry see Field 06B. W72-01567

A RIVER-WASHED MOUNTAIN CUT -- OPEN WAYS FOR URBAN RENEWAL, Corps of Engineers, Washington, D.C.

For primary bibliographic entry see Field 06B. W72-01570

STORM SEWER GRANT AIDS SEWER IM-

PROVEMENTS, Richmond Dept. of Public Works, Calif. For primary bibliographic entry see Field 04A. W72-01571

#### 3E. Conservation in Industry

WATER FOR INDUSTRY AND AGRICULTURE IN WASHINGTON COUNTY, MISSISSIPPI, Geological Survey. Jackson, Miss., Water Geological Survey, Jackson, Miss.,

Resources Div. R. E. Taylor, and F. H. Thomson.

Delta Council Report, Stoneville, Mississippi, 1971. 64 p, 30 fig, 13 tab, 13 ref.

Descriptors: \*Water resources development, \*Industrial water, \*Irrigation, \*Municipal water, Mississippi, Hydrologic data, Appraisals, Aquifers, Streamflow, Water quality, Geologic control, Planning, Mississippi River, Lakes, Groundwater movement, Water wells. Identifiers: Washington County (Miss).

The findings of a 2-year water study of Washington County, Miss. are presented in numerous figures and tables interspersed with descriptive material suited for water managers needs. An appraisal was

necessitated by industrial expansion in the Greenville Port area, the heavy reliance upon water for ir-rigation of large acreages, and population increase. The report describes the source, quantity, and facts about chemical quality and physical characteristics of the different groundwaters and surface waters. Groundwater usage for industrial, municipal and domestic supplies totals 15.6 mgd. Irrigation in 1968 used 15 billion gallons of groundwater (46,000 ac ft) and I billion gallons of surface water (3,070 ac ft). More than 50 billion gallons daily flows past the area in the Missispipi River, even in prolonged dry-weather periods. Lakes Washington and Lee could furnish more than 2 billion gallons of water annually. Five aquifers contain fresh water; base of fresh water is more than 2,000 ft below sea level in the northeastern part of the county. Southwest of Greenville the base of fresh water is less than 600 ft below sea level. Water of good quality is obtainable throughout the county. Deeper than 200 ft the water is soft, low in iron, has a pH above 7.2, and may be highly colored. Water in the alluvium is very hard, contains much iron, and has a pH from 6.0 to 8.2. (Lang-USGS) W72-01399

#### 3F. Conservation in Agriculture

DEGREE AND DEPTH OF SOIL WETTING DURING CROP IRRIGATION (STEPEN' I GLU-BINA UVLAZHNENIYA POCHVO-GRUNTA PRI POLIVAKH SEL'SKOKHOZYAYSTVEN-NYKH KUL'TUR),

Pochvovedeniye, No 2, p 60-65, February 1971. 1 fig, 2 tab, 10 ref.

Descriptors: \*Land reclamation, \*Soils, \*Wetting, \*Moisture content, \*Irrigation, Root development, Root systems, Plant growth, Crops, Chestnut soils, Clay loam, Bulk density.

Identifiers: \*USSR, Saratov Oblast, Volga River, Depth of wetting, Irrigation rates, Moisture capaci-

The problem of soil wetting during irrigation was examined for the case of a deep-seated ground-water table to develop procedures for improving irrigation rate computations. Relationships were proposed for determining the depth of soil wetting during the growing period with allowance for the growth and development of the root system of plants. The use of these relationships was based on an examination of Dark-Chestnut clay loam soils in the Transvolga region of the Saratov Oblast. (Josef-W72-01170

DETECTION OF HOMOCLIMATES BY NU-MERICAL ANALYSIS WITH REFERENCE TO THE BRIGALOW REGION (EASTERN AUSTRALIA) (AGRICULTURAL IMPORTANCE),

Commonwealth Scientific and Industrial Research Organization, St. Lucia (Australia). Div. of Tropiastures. J. S. Russell, and A. W. Moore

Agr Meteorol. 7 (6): 455-479. Illus. Maps. 1970. Identifiers: Agricultural, Australia, Brigalow, Climates, Detection, Eastern, Homo, Numerical.

Numerical methods including similarity coefficients, grouping procedures, sequential analysis and principal co-ordinates analysis are used to compare climatic data from 9 stations of the brigalow region of eastern Australia with various global stations. Homoclimes of this region are postulated in other parts of the world, particularly in southern Africa and America. Similarities in winter and summer climate of these areas were also determined. In comparing similarity coefficients, the Canberra Metric has advantages in the screening of large numbers of stations for the detection of ing of large numbers of successful and the large computer memory storage is not necessary. This coefficient is less affected by outlier values than Euclidean Distance but transformation of the temperature scale to avoid negative values is necessary. Euclidean Distance is satisfactory for comparing small num-bers of stations. The main advantages of agglom-crative numerical methods appear to lie in studies of particular climates, in the ease with which large numbers of parameters can be included and in the way that various periods of the year can be ex-amined.--Copyright 1971, Biological Abstracts, W72-01196

A SELECTION PROCEDURE IN WHEAT FOR

A SELECTION PROCEDURE IN WHEAT FOR STRESS ENVIRONMENT,
National Inst. of Sciences of India, New Delhi.
N. N. Roy, and B. R. Murty.
Euphytica. 19 (4): 509-521. 1970.
Identifiers: Adaptation, Drought, Environment,
Moisture, Procedure, Productivity, Selection,
Stress, Wheat-M.

simple and effective selection procedure for identifying lines with wide adaptation and ability to do well under drought is outlined, supported with experimental data involving diverse and high yield-ing populations of bread wheat. The effect of selections for local adaptation to stress environment is inferior to that of selection for developmental traits in a favorable environment. The developmental characters such as early vigor and synchronous tillering, days to heading and ear length which show stability over different environments are important components of wide adaptation and productivity under moisture stress.--Copyright 1971, Biological Abstracts, Inc. W72-01205

INFLUENCE OF TIME OF HARVEST AND EN-VIRONMENTAL FACTORS ON GRAIN YIELD AND MILLING BREAKAGE OF PADDY, Central Food Technological Research Inst.,

Mysore (India). K. A. Ranganath, M. K. Bhashyam, Rao Y. Bhaskar, and H. S. R. Desikachar.

J Food Sci Technol. 7 (3): 144-147. Ilus. 1970. Identifiers: Breakage, Environmental, Grain, Harvest, Milling, Moisture, Paddy-M, Time, Yield.

The effect of stage of harvest on milling breakage and grain yield was studied in 4 varieties of paddy. There was an optimal moisture content for harvest to get minimum milling breakage for each variety. A very slow increase in total yield/acre was observed even up to about 17% moisture below which there was a definite decrease with delayed harvest-ing in a few varieties. Milling breakage was also determined in paddy harvested in the forenoon and in the evening at different stages of harvest in 2 varieties over a 2-3 wk period. There was no difference in milling breakage as a result of drying caused on any particular day even till a late stage of harvest although cumulative drying over several days increased breakage. Protection of the standing days increased breakage. Protection of the standing crop against dew deposition by providing a cover reduced milling breakage. Breakage during milling caused by drying in the sun during the day and wetting by dew during nights cumulatively over a 3 wk period were about the same (10.6% and 12.9% respectively).—Copyright 1971, Biological Abstracts, Inc. W72-01206

OBSERVATIONS CONCERNING THE RELA-TION BETWEEN NUMBER AND SIZE OF STO-MATA COMPARING THEIR BEHAVIOUR TO MAIZE SHRIVELLING, (IN RUMANIAN), C. Cojocaru, Stela Simon, and I. Borcean.

Inst Agron Timisoara Lugr Stiint Ser Agron. 11: 239-252. Ilus. 1968. English summary. Identifiers: Behavior, Maize-M, Number, Relation, Shrivelling, Size, Stomata.

A plant was selected for studying the 3rd and 6th leaves and the leaf just below the ear. The number and size of stomates in the upper and lower epidermis, and in the superior, middle and inferior one-third of the leaf were determined. The stomate

maximun creased f near the mate den posite ac increase mate size ferent fo ferent fo mate. Th related. shrivellin Inc. W72-012

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# WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

#### Conservation in Agriculture—Group 3F

number was larger on the lower epidermis and was maximum in the middle. The stomate size in-creased from the lower leaves upward to the leaves near the ear. The N fertilizers increased the stomate density and size. The P fertilizers had an opmate density and see: the relations and account of the posite action. The delayed sowing date caused an increase in stomate density and decreased the stomate sizes. The different hybrids (HD 409, HSL 196, HD 311, 208 and 103) were significantly different properties. ferent for stomate size, but not significantly dif-ferent for density. HSL 196 had the smallest stomate. The response to drought and shrivelling were related. Fertilizer applications or sowing on dif-ferent dates may influence the resistance to shrivelling.—Copyright 1971, Biological Abstracts, W72-01207

CROPS WITHOUT GROWING PLOUGHING.

Foras Taluntais, Carlow (Ireland).

Ir J Agr Res. 9 (3): 391-400. Illus. 1970.

Identifiers: Amitrole, Barley-M, Crops, Dalapon, Growing, Herbicides, Paraquat, Pea-D, Plowing, Spring, Wheat-M.

Spring wheat was grown for 4 yr, barley for 2 yr and peas for 1 yr. On some occasions yields following chemical plowing were equal to those obtained with conventional plowing. The herbicides dalapon and amitrole T gave results similar to those obtained with paraquat. The establishment of crops following chemical plowing is, however, considered more weather dependent than is sowing by conventional methods.—Copyright 1971, Biological Abstracts. Inc. W72-01209

# BLUE GRAMA RESPONSE TO NITROGEN AND CLIPPING UNDER TWO SOIL MOISTURE

New Mexico State Univ., University Park. Dept. of

Range Management. Jerry L. Reed, and Don D. Dwyer

J Range Manage. 24 (1): 47-51. 1971. Identifiers: Blue, Bouteloua-Gracilis-M, Clipping, Fertilizer, Grama-M, Moisture, Nitrogen, Soil.

Effects of N-fertilization and clipping on production and water use of blue grama (Bouteloua gracilis) were evaluated under 2 soil moisture levels, field capacity and 1/5 available water. Nitrogen increased shoot production 77% on unclipped plants. Clipping decreased shoot production 287% below the control averaged across N levels. Soil moisture levels produced no difference in yields. Root weights were decreased an average of 253% below the control by clipping. No differences were observed in total water used between fertilized and unfertilized plants but clipping reduced water used by 95%. Unclipped plants fertilized with 80 lb n/acre used more water than unfertilized unclipped plants. The amount of water required to produce a unit of a shoot was reduced 37% when fertilized. Clipping lowered this water requirement an average of 98%. Nitrogen greatly increased seed stalk numbers and the increase in shoot production due to fertilization came primarily from increased numbers of seed stalks .-- Copyright 1971, Biological Abstracts, Inc. W72-01210

# EFFECT OF MINERAL FERTILIZERS ON WATER REGIME AND YIELD OF COTTON (IN

RUSSIAN), M. Tadzhiev, and A. K. Nosov.

Izv Akad Nauk Turkm Ssr Ser Biol Nauk. 3. 17-22. 1970. English summary

Identifiers: Cotton-D, Fertilizers, Mineral, Regime, Transpiration, USSR, Water, Yield.

Nitric fertilizers intensify transpiration of cotton plants, growing in North Turkmenia. Application of nitric, phosphate and potash fertilizers reduces transpiration, especially if applied with Zn and Cu.

Transpiration intensity progresses from low to upper plant layers. Mixed fertilizers regulate water charge and increase crop productivity.—Copyright charge and increase crop productivity.—Copyright 1971, Biological Abstracts, Inc. W72-01211

#### RAINFALL PATTERN AND MONTHLY FORAGE YIELDS IN THAL RANGES OF PAKISTAN,

Pakistan Forest Inst., Peshawar.

C. M. Anwar Khan.

J Range Manage. 24 (1): 66-70. Illus 1971. Identifiers: Cenchrus-Ciliaris-M, Dhaman-M, Elyonurus-Hirsutus-M, Forage, Karera-M, Monthly, Pakistan, Pattern, Rainfall, Ranges, Thal,

The multiple correlation and multiple regression between monthly forage yield of dhaman (Cenchrus ciliaris Linn.) and the 4 factors of the amount of monthly rainfall, the number of rainy days in the month, the amount of rainfall during the previous month and the month of the gro previous month and the month of the growing period were positive and highly significant (0.01 level). The same multiple relationships for karera (Elyonurus hirsutus Vah.) were significant only if rainfall during the previous month was not inraintai during the previous month was not in-cluded. There were highly significant positive cor-relation and regression relationships between forage yield and monthly rainfall, for both species. For either species, positive significant correlation existed between monthly forage yields and number of rainy days. Dhaman was more responsive then of rainy days. Dhaman was more responsive than karera to all 3 rainfall factors involved.—Copyright 1971, Biological Abstracts, Inc. W72-01212

#### A DIFFUSIVE RESISTANCE POROMETER FOR FIELD USE. I. CONSTRUCTION,

Rothamsted Experiment Station, Harpenden (En-

gland). W. Stiles.

J Appl Ecol. 7 (3): 617-622. Illus. 1970.

Identifiers: Construction, Diffusive, Field, Leaf, Porometer, Resistance, Stomata.

Details are given of the construction of a diffusion porometer to measure the stomatal resistance of leaf surfaces. The principle is the same as that used by van Bavel: water vapor from inside the leaf is allowed to diffuse into an initially dry cup clipped on to the leaf, and, after calibration, the surface re-sistance is estimated from the rate of increase of humidity in the cup. The humidity-sensing element is sulfonated polystyrene and the possible wide variety in size gives latitude in choice of cup dimensions and hence in the range of leaf sizes on which the equipment can be used.—Copyright 1971, Biological Abstracts, Inc. W72-01220

# A DIFFUSIVE RESISTANCE POROMETER FOR FIELD USE. II. THEORY, CALIBRATION AND

PERFORMANCE, Nottingham Univ. (England). School of Agricul-

J. L. Monteith, and T. A. Bull. J Appl Ecol. 7 (3): 623-638, Illus, 1970. Identifiers: Calibration, Cells, Diffusive, Epidermis,

Field, Guard, Humidity, Lamina, Leaf, Light, Mesophyll, Performance, Porometer, Resistance, Stomata, Temperature, Theory, Transpiration.

Compared with other field techniques for estimating leaf resistances, diffusion porometers of the type described in Stiles (1970) have advantages outweighing their complexity. Diffusion resistance can be determined for each epidermis separately as a simple function of a measured time. Becaus response of the instrument is independent of stomatal or mesophyll geometry, a single calibration curve derived from a set of standard resistances in the laboratory is valid for all leaves ralarge enough to fit the cup. The leaf is not subjected to pressure differences across the lamina that might distort the stomatal guard cells, and when the stomata are

fully open, a reading can be made 10-20 sec after the cup is secured. It is improbable that the stomatal opening will change much in such a short time in response to small changes of light intensity or relative humidity. Several workers have attempted to improve the van Bavel porometer by introducing a small motor-driven fan inside the to ensure rapid mixing of the air. Relative humidity is then kept uniform throughout the cup and in-creases exponentially with time. Ventilation helps to keep the source and cup isothermal and to prevent convection, but with a motor and fan attached, the cup is necessarily larger, heavier and more awkward to handle in the field. The difficulty of specifying the dynamic response of sensors raises problems of calibration. The theory established for the unventilated cup and subsequent field tests suggest that ventilation is unnecessary provided a number of principles are followed in the design. The detector should be plane and mounted parallel to the evaporating surface. Transit times measured with the porometer will then be strictly propor-tional to the square of the diffusion path-length, and other features of response can be derived from the theory of diffusion. To minimize errors in determining leaf resistance, the resistance of the cup itself should be kept small. Ideally the detector should be placed within a few millimeters of the leaf surface but when stomata are wide open, the transit time would then be inconveniently short. Proximity of detector and leaf would also help to ensure rapid temperature equilibration. The cup should be flushed to a relative humidity ho between 0.5 and 0.7 to avoid excessively fast transpiration. The change of relative humidity should be timed between ha (greater than 0.9 ho.. 0.1) and hb, say about 0.9. This range is intended to give a measura-ble minimum transit time for leaves with fully open stomata. As a compromise, the distance between source and detector could be made adjustable or the transit could be timed electronically. The temperature of the whole cup should be known (to about plus or minus 1.5 C) to estimate the total diffusion path to PLUS OR MINUS 2%. In practice, the cup temperature will usually change slowly enough to be taken at the beginning and end of a set of measurements rather than for each separate leaf.—Copyright 1971, Biological Abstracts, Inc. W72-01221

# EFFECTS OF MOISTURE STRESS ON (32)P UP-TAKE BY ROOTS OF ZEA MAYS CULTURED IN SAND AND SOLUTION,

Western Illinois Univ., Macomb. Dept. of Biological Sciences.

Phyton Rev Int Bot Exp. 27 (2): 149-155 Illus

Identifiers: Cells, Corn-M, Cortex, Cultured, Drought, Epidermis, Mannitol, Moisture, Drought, Epidermis, Mannitol, Moisture, Phosphorus-32, Roots, Sand, Solution, Stress, Sucrose, Uptake, Zea-Mays-M.

Detopped roots and lower stems of corn seedlings grown in solution culture lost water to hypertonic mannitol and sucrose solutions in accordance with osmotic theory. Moisture release curves of roots and lower stems of solution-grown plants, exposed to air were similar to those produced by hypertonic solutions except when surface water was removed at low stresses. One component of (32)P uptake by roots of detopped plants was strongly inhibited by moisture stress while another component was unaf fected. Drought destroyed the outer cortex and epidermis of roots grown in sand culture. Roots of intact plants were less sensitive to hypertonic solutions than to exposure to air, apparently because a steeper gradient in water potential exists from the root axis to the surface in air stressed roots, and although the mean water potential was the same in both treatments, the much lower water potential of the surface of air-stressed roots killed epidermal and some cortical cells .-- Copyright 1971, Biological Abstracts, Inc. W72-01225

## Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

## Group 3F-Conservation in Agriculture

THE INFLUENCE OF AN INCREASED WATER DEFICIT ON THE GAS EXCHANGE PROCESSES IN WHEAT PLANTS.

Navorsingsinstituut Wyndunde Wingerdbou, Stellenbosch (South Africa).

S. J. P. K. Bezuidenhout.

Tydskr Naruurwetensk. 9 (2/3): 144-151 Illus 1969

English Summary.

Identifiers: Cryoscopy, Deficit, Exchange, Gas, Light, Moisture, Osmotic, Photosynthesis, Plants, Porometer, Pressure, Processes, Respiration, Soil, Stress, Temperature, Transpiration, Wheat-M.

The photosynthetic, respiratory and transpiration rates of 2 wheat cultivars, 'Scheepers' and 'Betana, were continuously measured with 2 IR gas analyzers during increased soil moisture stress and after rewatering. Stomatal diffusion resistance was measured with a self-recording porometer. In addi-tion the osmotic values of expressed plant sap were determined cryoscopically. The test plants were grown under controlled conditions of light (0.12 cal cm-2 min-1) and temperature (25 plus or minus 2 C). During dehydration both cultivars showed decreased rates of photosynthesis, respiration and transpiration, accompanied by an increase in osmotic pressure and a decrease in stomatal aperture. Rehydration resulted in re-establishment of normal rates of photosynthesis, respiration and transpiration as well as in an increase in stomatal aperture and decrease in osmoti c pressure. When the cultivars were compared as to their ability to withstand increased dehydration and to recover after being rewatered, it was apparent that the cultivar 'Scheepers' has a higher osmotic pressure and can lose a greater amount of water before its physiological processes are disturbed by a water deficit. After rewatering, cultivar 'Scheepers' regained its normal photosynthetic, respiratory and transpiration rates sooner than cultivar 'Betana.' It appears that 'Scheepers' is better adapted to regulate its internal water balance than 'Betana.'--Copyright 1971, Biological Abstracts, Inc. W72-01226

OVERWINTER PRECIPITATION STORAGE IN IRRIGATED AND NONIRRIGATED LOAM SOIL.

Department of Agriculture, Lethbridge (Alberta).

Research Station. E. H. Hobbs, and K. K. Krogman.

Can J Soil Sci. 51 (1): 13-18 Illus 1971.

Identifiers: Autumn, Barley-M, Beet-D, Canada, Chin, Clover-D, Corn-M, Irrigated, Irrigation, Loam, Moisture, Nonirrigated, Overwinter, Prairie, Precipitation, Soil, Storage.

Overwinter changes in root zone soil moisture were recorded for 4 crops (barley, clover, beets, corn) under 4 moisture regimes during 8 seasons. Storage in the soil of overwinter precipitations was inversely related to the soil moisture content at harvests. Gains of soil moisture were directly related to spring precipitation but not to fall or winter precipitation. In the irrigated areas of the Canadian prairies, fall irrigation is advisable when soil moisture at harvest is in the lower half of the available moisture range.--Copyright 1971, Biological Abstracts, Inc. W72-01233

THE HYGIENIC EVALUATION OF GOOD CROPS GROWN IN SOIL IRRIGATED WITH INDUSTRIAL WASTE WATER, (IN RUSSIAN), Kiev Inst. of Nutritional Hygiene (USSR). N. M. Vorob'eva, V. S. Lapchenko, and Z. A.

Vop Pitan. 29 (4): 85-86. 1970. Identifiers: Beet-D, Chloride, Corn-M, Crops, Food, Grown, Hygienic, Industrial, Irrigated, Mouse, Negative, Poly, Production, Puppy, Soil,

Irrigation with waste water from polyvinyl chloride production was carried out 2 times during the growing season. The last irrigation was carried out 1-1 1/2 mo before harvest of corn or sugar beets. White mice and puppies were fed for 6 mo with the harvested vegetation. No significant changes were found in leukocytes, erythrocytes, Hb content blood sugar level, hippuric acid in urine and vitamin C content of liver, kidney and adrenals. The harvest and composition of vegetation from experimental fields did not differ from the control. -Copyright 1971, Biological Abstracts, Inc. W72-01243

STUDIES ON WATER MOVEMENT DISPERSION OF MOSQUITO LARVAE, WITH SPECIAL REFERENCE TO CONTROL IN RICE

FIELDS, Microbiological Research Establishment, Salisbury (England).

For primary bibliographic entry see Field 05G. W72-01255

MEASUREMENT OF RELATIVE TURGIDITY AND CELL SAP CONCENTRATION OF PLANT LEAVES FOR SCHEDULING IRLIGATION. Banaras Hindu Univ., Varanasi (India). Coll. of

Agriculture.

Ramadhar Singh J Indian Soc Soil Sci. 18 (2): 215-220. Illus. 1970. Identifiers: Bean-D, Cabbage-D, Cell, Concentra-tion, Irrigation, Leaves, Lettuce-D, Measurement, Moisture, Plant, Sap, Scheduling, Snap, Soil, Tur-

Cabbage, snapbeans, and lettuce were grown in the field at various soil moisture stresses. The relative turgidity of plant leaves decreased and cell sap concentration increased as the soil moisture stre creased. This relationship was true only up to about 4 bars soil moisture stress. Thereafter, the increasing soil moisture stress had no significant effect. The climatic condition and plant species also affect these leaf properties. For scheduling irrigation in the field, measurements of these propertie used successfully if properly corrected with factors affecting them and the growth and yield of crops.--Copyright 1971, Biological Abstracts, Inc. W72-01260

PLANT WATER STATUS OF APPLE TREES AND ITS MEASUREMENT IN THE FIELD: I. THE DYE TECHNIQUE FOR MEASUREMENT OF LEAF WATER POTENTIAL,

Department of Primary Industries, Applethorpe (Australia). Granite Belt Horticulture Research

K. R. Chapman.

Queensl J Agr Anim Sci. 27 (2): 203-209. Illus.

Identifiers: Apple-D, Dye, Field, Leaf, Measurement, Method, Plant, Potential, Shardakovs, Technique, Trees, Water.

A suitable field index of plant water stress was required for studies involving water usage by apple trees. A dye technique, developed after Shardakov's technique, and modified for use with leaf discs, is described. An assessment of the effects of disc size and equilibration time on measured water potentials is made for 3 apple varieties under dif-ferent stress conditions. The larger disc size (16 mm diam.) and an equilibration time of 4 hr were chosen to minimize early 'time' effects and con-tamination errors, which are discussed in relation to measured potentials.--Copyright 1971, Biological Abstracts, Inc. W72-01271

PLANT WATER STATUS OF APPLE TREES AND ITS MEASUREMENT IN THE FIELD: II. COMPARISON OF THE DYE TECHNIQUE AND THE VAPOUR EQUILIBRATION TECHNIQUE FOR MEASUREMENT OF LEAF WATER

POTENTIAL,
Department of Primary Industries, Applethorpe (Australia). Granite Belt Horticulture Research

Queensl J Agr Anim Sci. 27 (2): 211-214. Illus. 1970.

Identifiers: Apple-D, Dye, Equilibration, Field, Leaf, Measurement, Method, Plant, Potential, Shardakovs, Slatyers, Technique, Trees, Vapor.

The dye technique, developed after Shardakov's The dye technique, developed after Shardakov's method, for the measurement of leaf water potentials may be subject to contamination errors or errors arising from solute uptake by leaf discs. A measure of this total error arising from these sources was made by a comparison of the dye method with Slatyer's vapor equilibration technique. Differences in leaf water potentials measured with the 2 techniques were small and limits were not in excess of plus or minus 1 atm for the 3 apple varieties tested. The accuracy, speed and portability of the dye method should make this method quite suitable for field measurements of plant water stress in apple trees.—Copyright 1971, plant water stress in apple trees.--Copyright 1971, Biological Abstracts, Inc. W72-01272

PLANT WATER STATUS OF APPLE TREES AND ITS MEASUREMENT IN THE FIELD: III. SOME SOURCES OF VARIATION IN THE WATER POTENTIAL OF APPLE LEAVES IN

THE FIELD,
Department of Primary Industries, Applethorpe
(Australia). Granite Belt Horticulture Research

Queensl J Agr Anim Sci. 27 (2): 215-218. 1970. Identifiers: Apple-D, Crop, Distribution, Dye, Field, Height, Insertion, Leaf, Leaves, Measurement, Plant, Potential, Stress, Technique, Trees.

Leaf water potentials may vary with leaf insertion height for some species, giving rise to errors dependent on sampling heights. Leaf position and leaf age at one insertion height could also influence measured water potentials. For the apple tree, leaf water potentials determined with the dye technique differed with insertion height. These differences were appreciable and point to the need for standardizing sampling height for routine stress measurement. With different leaf ages and positions some differences in observed leaf potentials were noted; therefore both of these also need to be standardized in sampling procedures. Stress condition, corp distribution, fruit-bearing characteristics, competition between young and mature leaves, and the relationships between leaf and fruit water potentials can all influence observed differences in leaf potentials with height, age and position. Further studies are required to evaluate more care-fully the specific reasons for the observed differences with each apple variety.--Copyright 1971, Biological Abstracts, Inc. W72-01273

PLANT WATER STATUS OF APPLE TREES AND ITS MEASUREMENT IN THE FIELD: IV. STOMATAL APERTURE, DETERMINED BY INFILTRATION SCORING, AS AN INDEX OF LEAF WATER POTENTIAL, Department of Primary Industries, Applethrope (Australia). Granite Belt Horticulture Research

Queensl J Agr Anim Sci. 27 (2): 219-224. Illus. 1970

1970.
Identifiers: Aperture, Apple-D, Determined, Evaporation, Field, Index, Infiltration, Irrigation, Leaf, Light, Measurement, Plant, Potential, Scoring, Stomatal, Trees, Water, Wind.

Stomatal aperture has been used by a number of workers as a physiological indicator of plant water status. With apples, early work shows that stomatal aperture may provide a useful and sensitive mea-sure of plant responses to applied water and the onset of stress conditions. Apertures were assessed in the field with an infiltration technique using liquid medicinal paraffin in preference to a diffu sion porometer, which presented construction difficulties. Infiltration scores at almost complete sto-

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## WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

# Conservation in Agriculture—Group 3F

matal closure (which was assessed microscopically for 3 apple varieties) were recorded as an approxi-mation of permanent wilting point. Values for the 3 varieties differed, this being attributed to the relative pubescence of the ventral leaf surfaces. The relationship between stomatal aperture and leaf water potential was established for 3 apple varieties, since all plant water status measurements should be related back to water potential. The scoring technique for stomatal aperture was somewhat less accurate than the dve method for assessing leaf water potential; however, the technique was faster and more sensitive than the relative water content method. Problems of reduced light intensity, increased wind speed, time of day for testing and the evaporative environment are discussed in relation to the use of infiltration scoring for stomatal aperture of apple trees in the Stanthorpe district of south-eastern Queensland. It appears that while infiltration scoring for apertures may be somewhat less accurate, the fact that stomatal aperture responds quickly to the onset of stress may partly compensate for this inaccuracy, and makes the method suitable for field irrigation indexing.--Copyright 1971, Biological Abstracts, Inc. W72-01274

PLANT WATER STATUS OF APPLE TREES AND ITS MEASUREMENT IN THE FIELD: V. THE DYE TECHNIQUE FOR THE MEASURE-

MENT OF FRUIT WATER POTENTIAL,
Department of Primary Industries, Applethorpe
(Australia). Granite Belt Horticulture Research Station

Queensl J Agr Anim Sci. 27 (2): 225-229. Illus. 1970.

Identifiers: Apple-D, Dye, Field, Fruit, Measure-ment, Plant, Potential, Technique, Trees.

Of the techniques available for the measurement of water potentials in plant storage organs, most are inconvenient and unsatisfactory for field use. The dye method, a densiometric technique, was developed for the measurement of apple fruit water potentials in the field. A description of the technique is given. Provided precautions relating to fruit exposure, equilibration time and fruit insertion height are observed, the technique appears to be satisfactory for field use. The causal effects of variable fruit insertion heights on fruit water potentials require further investigation .-- Copyright 1971, Biological Abstracts, Inc. W72-01275

RESPONSE OF CABBAGE CROWN NORTH OF LATITUDE 60 DEG. N TO PLASTIC MULCH, RIDGING, AND ROW ORIENTATION,

Department of Agriculture, Morden (Manitoba). Research Station.

Can J Plant Sci. 51 (1): 17-20. Illus. 1971. Identifiers: Cabbage-D, Degrees, Grown, Growth, Latitude, Mositure, Mulch, North, Orientation, Plastic, Ridging, Row, Soil, Temperature, Yield.

The effects of clear polyethylene mulch, soil ridges, and row orientation on soil temperature, soil moisture and crop growth were studied in field experiments north of latitude 60 deg., with cabbage as the test crop. Mulch increased soil temperature and cabbage yield regardless of ridge type and row orientation. Soil temperature differences between mulched plots were small at 8:00 a.m. but large at 3:30 p.m. The highest temperatures at 3:30 p.m. were obtained in the even-ridge, followed in decreasing order by uneven-ridged, no-ridged and double-ridge treatments. Soil moisture levels were lower in the mulched single-ridge plots than in the mulched double-ridge and no-ridged plots. No dif-ferences were found between single ridges running north-south and single ridges running east-west.--Copyright 1971, Biological Abstracts, Inc. W72-01276

ECOLOGICAL STUDIES ON THE WEEDS OF AGRICULTURAL FIELDS: I. PERSISTENCE OF PORTULACA QUADRIFIDA L. AGAINST DESICCATION, Shivaji Coll., New Delhi (India). Satya Prakash Shukla.

Proc Nat Acad Sci India Sect B Biol Sci. 39 (1/2): 145-157. Ilus. 1970.

Hospital Avoidance, Desiccation, Drought, Ecological, Fields, Fragmentation, Portulada-Quadrifida-D, Propagation, Tolerance, Tolerance,

Drought-tolerance and drought-avoidance were studied. Anatomical features contributing to the xerophytic nature of the weed are noted. Under sub-lethal desiccation the weed are noted. Once sub-lethal desiccation the weed may propagate by fragmentation. Drought as a control measure may not be very effective. This weed is a migrant from xeric habitats.—Copyright 1971, Biological Abstracts, Inc. W72-01302

DOES THE MOON INFLUENCE LIFE ON

EARTH, Massandro. 10a

Flora (Quito). 13 (47-50): 219-223. 1969. Identifiers: Climate, Crops, Earth, Human, Life, Moon, Superstitions.

Ancient superstitions about the supposed influence of the moon on human life and on crops are reviewed and discarded. Its effect on the tides is seasons are placed in the doubtful category.—Copyright 1971, Biological Abstracts, Inc.
W72-01323

EFFECTS OF PESTICIDE USAGE ON WATER

QUALITY, Wisconsin Univ., Madison. Water Resources Center.

For primary bibliographic entry see Field 05C. W72-01326

ECONOMIC STUDIES ON PRODUCTIVITY OF IRRIGATED CROPS AND SOURCES OF IRRIGATION IN UTTAR PRADESH, Indian Council of Agricultural Research, New Delhi (India); and Uttar Pradesh Agricultural Univ., Naini Tal (India). Dept. of Agricultural Economics

A. Singh, I. J. Singh, and V. K. Berry. Indian Journal of Agricultural Science, Vol 41, No 5, p 427-430, May, 1971. 3 tab.

Descriptors: \*Irrigation water, \*Crop response, \*Marginal productivity, \*Net profit, Variable costs, Economic efficiency, Irrigation efficiency,

Identifiers: Pantnagar (India).

Data obtained from Uttar Pradesh Agricultural University, Pantnagar, in 1967-68 were utilized to estimate (1) the yield potential of different crop estimate (1) the yield potential or different copy rotations with irrigation, (2) marginal profit with ir-rigation facilities for potato and Indian rape crops, (3) the marginal-value productivity of irrigation water, and (4) the cost of irrigation by different sources. Results indicated that with irrigation a net income of Rs 10,344 per ha was earned from a maize, Indian rape, wheat, cowpea rotation. Without irrigation, only Rs 2,183 per ha was earned from a maize, wheat rotation. With irrigation facilities an additional net profit of about Rs 90 per day per ha from potato or about Rs 35 per day per ha from In-dian rape was earned. The marginal-value produc-tivity to irrigation water diminished and became zero when 15.27 ha-cm of water was applied to wheat, indicating that irrigation water was al-located efficiently. The efficiency of irrigation channels was the only factor contributing to variation in the cost of irrigation water, implying that the water supplied to the fields was proportional to the efficiency of the channels used. (Settle-Wisconsin) W72-01346

EVALUATION OF INVESTMENT IN IRRIGA-TION UNDER RISK, Illinois Univ., Urbana. Dept. of Agricultural

M. A. A. El-Saadi.

Illinois University at Urbana-Champaign, Urbana, Illinois, Ph.D. Thesis, July, 1971. 133 p, 2 fig, 26 tab, 48 ref. OWRR B-049-Ill (1).

Descriptors: \*Illinois, \*Risks, \*Investment, \*Sup-plemental irrigation, Statistical models, Decision making, Future planning (Projected), Evaluation. Identifiers: Utility function.

Because of the interest among farmers in adopting supplemental irrigation, investment and production decisions need to be analyzed under the typical dynamic and uncertain conditions of farming. The financial consequences of irrigation were estimated and evaluated for an irrigated farm over a 10-year period in Mason County, Illinois, and were described in terms of parameters representing described in terms of parameters representing present and future conditions. A simulation model was used to estimate the variance and mean values was used to estimate the variance and mean values of five financial criterion functions (farm operator's utility functions) and four farm policies representing stages in the expansion of irrigation in 100-acre increments. The financial criterion included (1) annual cash operating income, (2) annual net cash operating income, (3) annual net farm income, (4) accumulated cash and (5) accumulated to the control of the control mulated net worth. 'F' and 't' tests were conducted to detect statistically significant differences in the variance and mean values among alternative plans.
The plans were then ranked and the farm operator The plans were then ranked and the farm operator chose one according to his utility function (accumulated cash, in this case) and his desire to increase irrigation. The results provide a general method of policy evaluation under risk by simulation, applicable to other farm operators making investment decisions under similar physical and economic conditions. (Haugh-Wisconsin) W72-01351

WATER FOR INDUSTRY AND AGRICULTURE IN WASHINGTON COUNTY, MISSISSIPPI, Geological Survey. Jackson, Miss., Water Geological Survey, Jackson, Miss., Resources Div. For primary bibliographic entry see Field 03E. W72-01399

RESEARCH PROGRESS REPORT--1970: PAN-HANDLE RESEARCH STATION, GOODWELL,

Oklahoma State Univ., Goodwell. Panhandle Experiment Station.

Oklahoma Agricultural Experiment Station, Progress Report P-641, October 1970. 35 p.

Descriptors: \*Oklahoma, \*Precipitation (Atmospheric), \*Evaporation, \*Irrigation, \*Mositure, Rainfall, Humidity, Growing season, Wind valocity, Groundwater, Crop production, Grains (Crops), Forages, Sorghum, Specialty crops, Soil management, Drought resistance, Irrigation effects, Irrigation effects, Errigation efficiency, Moisture uptake.

A research progress report of a semi-arid agricultural station in the Oklahoma panhandle. The 1969 precipitation and evaporation was 20.07 and 73.11 inches respectively. The 43-acre station has a 59-year precipitation average of 17.32 inches. Low rainfall and humidity, long growing season, and high wind velocities necessitate groundwater irrigation to insure stable crop production. The 16 investigations are divided into small-grain, grain and forage sorghum, forage crops, special crops, and crop and soil management studies. Drought resistance, irrigation effects and efficiency, and moisture-use efficiency are important aspects of this project. (Popkin-Arizona) W72-01444

AIR, WATER AND SOIL POLLUTION. Colorado State Univ., Fort Collins. For primary bibliographic entry see Field 05G.

# Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

## Group 3F—Conservation in Agriculture

W72-01446

HERBICIDAL CONTROL OF CROTON, Agricultural Research Service, Beltsville, Md. Crops Research Div. For primary bibliographic entry see Field 04A. W72-01457

CONTROLLING INTERNAL PLANT WATER BALANCE THROUGH MICROCLIMATE BALANCE THROUGH MANIPULATION,

Michigan State Dept. of Univ., East Lansing. Dept of Horticulture.

P. A. Gerakis, and R. L. Carolus. Agrochimica August-October 1970, Vol 14, No 5-6, p 441-452. 1 tab, 1 fig, 67 ref.

Descriptors: \*Water balance, \*Microclimatology, \*Crop production, \*Water requirements, \*Mist irrigation, Control, Plant growth regulators, Plant physiology, Physiological ecology, Optimization, physiology, Physiological ecology, Optimization, Irrigation efficiency, Irrigation practices, Evaporation, Transpiration, Photosynthesis, Respiration, Translocation, Consumptive use, Air temperature, Solar radiation, Humidity, Sprinkler irrigation, Water conservation, Cooling.

This paper points out the importance of climate in the study of internal water balance and physiological processes of crops. It discusses the potentialities of manipulating crop microclimate through evaporative cooling to optimize irrigation efficiency. Evaporation, transpiration, photosynthesis, respiration, translocation and water needs for crops are evaluated in terms of climatic factors on plant water balance. Air temperature, radiation and humidity are the most important controls for water balance. Crop shading and field misting (sprinkler irrigation) are advocated microclimatological techniques for manipulating plant water balance. (Popkin-Arizona) W72-01458

OBSERVATIONS ON THE FUNCTIONAL ACTION OF DICAMBA (2-METHOXY-3, 6 DICHLOROBENZOIC ACID) IN CYPERUS ROTUNDUS.

Instituto Agronomico, Campinas, (Brazil). Section

of Plant Physiology.
For primary bibliographic entry see Field 04A.
W72-01459

LEAF ENLARGEMENT AND METABOLIC RATES IN CORN, SOYBEAN AND SUN-FLOWER AT VARIOUS LEAF WATER POTEN-

Hilinois, Univ., Urbana. Dept of Botany. For primary bibliographic entry see Field 02I. W72-01460

UNIVERSITY CREATES DESERT FARM AS MODEL FOR WORLD'S ARID AREAS, 21NEWS FROM THE HEBREW UNIVERSITY OF JERUSALEM, NO. 5-6, MAY-JUNE 1971, P. 1--14, 2 FIG.

Hebrew Univ. Jerusalem (Israel). Dept. of Information and Public Affairs.

Descriptors: \*Crop production, \*Irrigation practices, \*Water conservation, \*Land reclamation, \*Cultivation, Arid lands, Farm management, Exreturnation, Arti lands, Farm management, Experimental farms, Runoff, Rainfall, Nuts, Fruit crops, Vegetable crops, Barley, Wheat, Oats, Alfalfa, Training, Costs, History, Climates, Terracing, Water distribution (Applied). Identifiers: \*Israel, \*Negev.

A large 12-year old desert farm in the Negev demonstrates that bountiful crops can be grown in arid areas without conventional irrigation. Water conservation; land reclamation; and desert cultivation of nuts, fruits, vegetables, barley, wheat, oats and alfalfa are primary areas of interest. The 3750acre farm is near Wadi Mashash, 20 km south of

Beersheba. The ancient parctice of runoff farming provides a center of focus for this international training school for hydrologists. The runoff system is simple and inexpensive. Runoff water is collected is simple and inexpensive. Kunoti water is consecuted from sparse winter rains over a large region and concentrated on a much smaller area. Experience in botany, archeology, ecology, hydrology, and water engineering is combined to husband every drop rain water by terracing and modern water dis-tribution. (Popkin-Arizona) W72-01461

ON THE QUESTION OF THE EXISTENCE OF SINGULARITIES IN THE SUMMER RAINFALL OF THE SOUTH AFRICAN MAIZE GROWING REGION,

Weather Bureau, Pretoria (South Africa). W. L. Hofmeyr. Notos, Vol. 18, No. 1/4, p. 71-78, 1969.

Descriptors: \*Crops, \*Dry farming, \*Dry farming, \*Rainfall disposition, \*Droughts, Climatic data, Semiarid climates, Statistical methods, Summer.

Dryland farming in the Maize Triangle of the South African plateau begins in November and flowering occurs in January. The appearance of rain in the occurs in January. The appearance of rain in the latter month is therefore a decisive factor in successful maize production. A study was undertaken to determine whether, in fact, observed rainfall anomalies at this critical stage are singularities. The analysis was confined to the 4 highest rainfall months, November to February. A semilogarithmic relationship was found to exist between the frequencies of dry and wet spells and their durations. Singularities do not exist in the sense that spells are longer in one month than in another. spells are longer in one month than in another. When the number of days of rain or no rain was plotted against the duration of rainy and dry spells, damped aperiodic oscillations were obtaine their general exponential forms were derived. Most consecutive days of rain, or alternately, of no rain, are associated with spells of 2 or 3 days duration. (Casey-Arizona) W72-01464

DIVISION OF PLANT SOIL AND WATER SCIENCE.

Nevada Univ., Reno. Div. of Plant Soil and Water

Nevada Ranch and Home Review, Spring 1970, Vol. 4, No. 7, p. 3-5. 9 fig.

Descriptors: \*Crop production, \*Soil management, Descriptors: "Crop production," soin management, "Waste management (Applied), "Water policy, "Nevada, Climatology, Field crops, Horticulture, Irrigation, Drainage, Plant pathology, Soil science, Weeds, Afalfa, Forestry, Hydrology, Soil surveys, Universities.

Resources and management of plants, soil and water is the scope of interest of the Division of Plant, Soil and Water Science, University of Nevada. Programs cover bioclimatology, field crops, horticulture, irrigation and drainage, plant pathology, soil and weed science. Alfalfa is a major study area throughout Nevada. Soil, forestry, irrigation, and hydrologic investigations are being rigation and hydrologic investigations are being developed as a base for a statewide water plan. (Popkin-Arizona) W72-01465

DIVISION OF AGRICULTURAL AND RESOURCE ECONOMICS,
Nevada Univ., Reno. Div. of Agricultural and

Resource Economics. J. R. Garrett.

Nevada Ranch and Home Review, Vol. No. 7, Spring 1970, p. 9-11. 6 fig.

Descriptors: \*Economic impact, Water resources, \*Land use, \*Recreation, \*Community development, Agriculture, Water utilization, Nevada, Limiting factors, Water management (Applied), Basins, Grazing, Water demand, Sewers, Cropproduction, Marketing, Irrigation.

Water resource use, land resources, recreation, community development and agriculture are discussed in terms of Nevada's economic development. Water is a major limiting factor on the economy. Local water management projects in various basins are discussed. Water-based recreation and grazing fees are economically important. Agriculture and agribusiness is linked to crop production, marketing, and implicitly, to irrigation. (Popkin-Arizona) W72-01466

COLLEGE SEES NEED FOR RESOURCE MANAGEMENT...THUS NEED FOR A RENEWABLE NATURAL RESOURCES DIVI-SION, Nevada Univ., Reno. Div. of Renewable Natural

For primary bibliographic entry see Field 04A. W72-01467

SOIL AND WATER,

R. F. Loxton. South African Journal of Science, Vol. 67, No. 3, p. 137-139, March 1971, 2 tab.

Descriptors: \*Arid lands, \*Irrigation practices, \*Irrigation efficiency, \*Soil properties, Humid climates, Rainfall, Soil types, Land management, Environmental effects, Water utilization.

In South Africa, agriculture has historically enjoyed a privileged position with respect to water use. A national obsession for self-sufficiency in all things, particularly food production, has been translated into various 'make the desert bloom' projects. It is asserted this unrealistic view has resulted in gross misappropriation of limited na-tional water supplies. Arid land irrigation schemes have achieved spectacular successes in the conversion of barren waste lands to productive agricul-ture, but the gains have been more apparent than real. Such regions have experienced great problems in drainage and soil salinity. Tables are presented showing the efficiency of water use of maize under varying climatic conditions. Without question, the varying climate conditions. without question, in more most effective water use was accomplished in more moist regions (S30 in. rainfall per year). It is therefore argued that the irrigation potential of more humid regions should be exploited at the expense of the arid regions. Although soil problems are the major barrier to agriculture in the arid lands, some limited development may be possible by careful land management, and some possible approaches are briefly discussed. (Casey-Arizona) W72-01471

THE EFFECT OF SPRINKLING INTENSITY AND SOIL TYPE ON OXYGEN FLUX DURING IRRIGATION AND DRAINAGE, Hebrew Univ., Rehovoth (Israel). Dept. of Irriga-

For primary bibliographic entry see Field 02G. W72-01525

INFILTRATION FROM A TRICKLE SOURCE: I. MATHEMATICAL MODELS, Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Applied Mathematics. For primary bibliographic entry see Field 02G. W72-01526

INFILTRATION FROM A TRICKLE SOURCE: II. EXPERIMENTAL DATA AND THEORETICAL PREDICTIONS,

Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). For primary bibliographic entry see Field 02G. W72-01527

STEADY INFILTRATION FROM SOURCES, CAVITIES, AND BASINS, Johns Hopkins Univ., Baltimore, Md. For primary bibliographic entry see Field 02G. W72-0

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## WATER QUANTITY MANAGEMENT AND CONTROL-Field 04

# Control of Water on the Surface-Group 4A

W72-01528

FIGHT FROST DAMAGE WITH FERTILIZA-TION, J. F. Trierweiler.

Better Crops Plant Food. 60 (1): 1971. 16-18. Identifiers: Absorption, Corn-M, Damage, Fertilization, Fight, Frost, Heat, Moisture, Retention, Soil. W72-01594

SUGAR BEETS-D IN ARIZONA.

R. E. Dennis, and J. M. Nelson. Univ Ariz Coop Ext Serv Bull. A-71: 1970. 1-6. Identifiers: Arizona, Beets-D, Disease, Fertilizers, Harvesting, Insect, Irrigation, Pests, Soil, Sugar, Weeds. W72-01595

IRRIGATION OF MELON-D, WATERMELON--D, AND CUCUMBER-D FIELDS

Notic Agr Serv Shell Agr. 6 (1): 1971. 2-3. Identifiers: Cucumber-D, Fields, Growth, Irrigation, Melon-D, Water, Watermelon-D. W72-01617

EFFECT OF AN ICE CRUST ON GAS COMPOSITION OF THE INTERNAL ATMOSPHERE IN WINTER WHEAT-M,

Z. G. Rakitina. Sov Plant Physiol. 17 (5): 1970. 755-759.

Identifiers: Accumulation, Anaerobiosis, Atmosphere, Carbon, Composition, Crust, Di, Exchange, Gas, Ice, Internal, Leaves, Oxide, Wheat-M, Winter. W72-01620

WATER CONSUMPTION AND WATER SUPPLY OF TEA-D PLANTATIONS IN THE SUBTROPICS OF KRASNODAR KRAY,

Sov Soil Sci (Transl Pochvoved). 2 (5): 1970. 634. Identifiers: Consumption, Krasnodar, Kray, Plantations, Soil, Subtropics, Tea-D, USSR. W72-01625

EQUILIBRIUM MOISTURE CONTENT OF SMALL GRAIN HYSTERESIS.

Trans ASAE (Amer Soc Agr Eng). 13 (6): 1971. 762-764.

Identifiers: Equilibrium, Grain, Hysteresis, Moisture, Rice-M, Wheat-M. W72-01631

PREDICTING IRRIGATIONS FROM CLI-MATIC DATA AND SOIL PARAMETERS, C.E. Franzoy, and E. L. Tankersley. Trans ASAE (Amer Soc Agr Eng). 13 (6): 1971.

Identifiers: Citrus-D, Climatic, Cotton-D, Forage, Grain, Irrigations, Oil, Parameters, Predicting, Radiation, Soil, Solar, Temperature, Vegetable. W72-01632

Trans ASAE (Amer Soc Agr Eng). 13 (6): 1971. 885-890.

Identifiers: Control, Crop, Irrigation, Mathematics, Moisture, Soil, Sprinkler, Yield. W72-01633

FOOD CONTROL IN SWITZERLAND IN 1969. PART 2. SUMMARIES OF REPORTS OF THE CANTONAL SUPERVISORY AUTHORITY OF OFFICIAL LABORATORIES AND FOOD IN-SPECTIONS, RIGHT AND LEFT BIOLOGICAL OBJECTS IN NATURE,

E. Matthey. Mitt Geb Lebensmittelunters Hyg. 61 (1): 1970.

Identifiers: Authority, Bread, Cantonal, Contamination, Control, Eggs, Fermented, Fish, Food, Fruit, Fungi, Honey, Insecticides, Inspections, Laboratories, Liquors, Meat, Milk, Summaries, Supervisory, Switzerland, Vegetables. W72-01635

BREWING BARLEY-M 1970 HARVEST IN

W. Wilten Int Tijdschr Brouw Mout. 30 (4): 1970-1971. 97-

Identifiers: Bad, Barley-M, Brewing, Crop, Europe-an, Harvest, Holland, Weather. W72-01636

#### 04. WATER QUANTITY MANAGEMENT AND CONTROL

### 4A. Control of Water on the Surface

SOME PROBLEMS OF FLOOD ANALYSIS,

Colorado State Univ., Fort Collins. Engineering Research Center.
P. Todorovic, and J. Rousselle.

Water Resources Research, Vol 7, No 5, p 1144-1150, October 1971. 3 fig, 1 tab, 10 ref.

\*Flood forecasting, \*Stochastic processes, \*Statistical models, Frequency analysis, Mathematical models, Probability, Peak discharge. Identifiers: \*Flood probability, \*Flood frequency.

A stochastic model for analyzing excessive streamflows is based on the assumption that flood peak exceedances are independent, identically dis-tributed random variables and that their occurrence is subject to the Poisson law. This model was developed for nonidentically distributed ex-ceedances on the assumption that only those exceedances during a particular season may be considered identically distributed. From this hypotheses the distribution function of the maximum flood peak exceedance in an arbitrary interval of time was determined. The results were then applied to the 72-year record of the Greenbrier River at Alderson, West Virginia. The theoretical and observed results agree reasonably well. (Knapp-USGS) W72-01124

FLOOD ROUTING IN CHANNELS WITH BANK SEEPAGE.

Virginia Polytechnic Inst. and State Univ., Blacksburg. V. L. Zitta, and J. M. Wiggert.

Water Resources Research, Vol 7, No 5, p 1341-1345, October 1971. 3 fig, 1 tab, 16 ref.

Descriptors: \*Flood routing, \*Routing, \*Alluvial channels, \*Bank storage, \*Simulation analysis, Numerical analysis, Base flow, Porous media, Surfacegroundwater relationships, Mathematical models, Hydrographs, Hydrograph analysis. Identifiers: Flood waves.

Bank seepage occurs along natural streams bounded by an alluvial material when the passage of a flood wave produces a rise and fall in the stream stage. Owing to the difficulties of measuring flow rates in a porous medium, the quantity of bank seepage and its effect on the attenuation of a flood wave have not been determined from experimental observations. As an alternative, the equations of motion were used to describe flood flows in an idealized rectangular channel bounded by banks of a homogeneous, isotropic, porous medium in which the Boussinesq equation governs flow. The channel and the banks were assumed to be underlain by an impervious layer. Numerical simulation of a sinusoidal flood wave in the channel showed that

bank seepage causes significant attenuation of the wave in narrow channels bounded by a relatively pervious material. This attenuation is characterized pervious material. This attenuation is characterized by a reduction in the hydrograph peak and sustenance of the flow during recession. In wide channels and in channels bounded by a relatively impervious material, no significant attenuation of the flood wave occur. (Knapp-USGS) W72-01142

CIS AND TRANS LINKS IN NATURAL CHAN-NEL NETWORKS,

IBM Watson Research Center, Yorktown Heights,

J. S. Smart, and J. R. Wallis. Water Resources Research, Vol 7, No 5, p 1346-1348, October 1971. 2 fig, 3 ref.

Descriptors: \*Geomorphology, \*Drainage patterns (Geologic), \*Statistical models, \*Tributaries, Junc-tions, River systems, Streams, Statistics, Statistical methods, Probability, Monte Carlo method. methods, Probability, Manual Identifiers: Tributary geometry.

A proposed explanation of the excess of trans links over cis links in natural channel networks is: (1) channel networks develop by headward growth,

(2) tributaries are generated independently on the
two sides of the main channel, and (3) once a tributary has been established, the probability of other tributaries developing further downstream on the same side is greatly diminished. Computer simulations of a simplified version of this model produce networks with about 58% trans links. A main channel link is called a cis link if the tributaries at the upstream and downstream ends enter the main channel from the same side, and a trans link if they enter from oposite sides. In eastern Kentucky, a sample of 485 interior links had 293 trans links and 192 cis links (60.4% trans). (Knapp-USGS) W72-01143

ESTIMATION OF UNCONFINED GROUND WATER FLOW TO DITCHES,

Dievd. Technikon Ypiresion, Ioannina (Greece).

Journal of Hydrology, Vol 13, No 4, p 338-342, September 1971. 5 ref.

Descriptors: \*Groundwater movement, \*Ditches, \*Drainage systems, Water levels, Drawdown, Equations, Mathematical studies, Discharge (Water), Water yield, Infiltration, Water table. Identifiers: \*Drainage ditches.

Prediction of groundwater flow to drainage ditches is of some practical importance in drainage studies. Simple formulae are based on the well known linear differential equation of groundwater flow. They enable a quick step by step computation of groundwater flow corresponding to any assumed infiltration sequence uniformly distributed over the basin under study. The single parameter in the formulae, which lumps the physical and geometric properties of the aquifer, can be easily determined from an observed recession of groundwater levels or groundwater discharge. Thus estimates of the physical parameters of the aquifer are not necessary for the application of the approach. (Knapp-USGS) W72-01149

FLOOD PLAIN INFORMATION, SANTA CRUZ RIVER (STATE HIGHWAY 82 TO INTERNA-TIONAL BOUNDARY), SANTA CRUZ, ARIZONA.

Army Engineer District, Los Angeles, Calif.

Army Corps of Engineers Flood Plain Report, January 1971. 11 p, 4 fig, 11 plate, 3 tab.

Descriptors: \*Floods, \*Flood damage, \*Flood plains, \*Arizona, Regional flood, Flood forecasting, Flood control, Historic flood, Peak discharge. Identifiers: \*Floods (Santa Cruz County, Ariz), Standard Project Flood, Intermediate Regional

# Field 04-WATER QUANTITY MANAGEMENT AND CONTROL

# Group 4A—Control of Water on the Surface

Flooding along the Santa Cruz River in Santa Cruz County, Arizona is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections and other material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. The velocity of water in the channel of the Santa Cruz River in the study reach for the Intermediate Regional and Standard Project Floods would generally range from 7 to 16 feet per second. These velocities would cause a significant amount of bank cutting and scour to the riverbed. The velocity of water on the flood plain outside the channel would generally range from 1 to 7 feet per second. These velocities would cause the deposition of silt and debris on the overbank areas along the river. An Intermediate Regional Flood is a flood that has an average frequency of occurrence of once in 100 years, although this flood may occur in any year. A Standard Project Flood is a flood that may be expected from the most severe combination of meteorological and hydrological conditions.
(Woodard-USGS) W72-01156

FLOOD PLAIN INFORMATION, FARMINGTON AND CONNECTICUT RIVERS, WINDSOR, CONNECTICUT.

Army Engineer District, Waltham, Mass.

Army Corps of Engineers Flood Plain Report, March 1971. 44 p, 10 fig, 8 plate, 7 tab.

Descriptors: \*Floods, \*Flood damage, \*Flood plains, \*Connecticut, Regional flood, Flood forecasting, Flood control, Historic flood, Peak discharge.

Identifiers: \*Floods (Windsor, Conn), Standard Project Flood, Intermediate Regional Flood.

Flooding along the Connecticut and Farmington Rivers in Windsor, Connecticut is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections and other material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. Stages on the Connecticut River have taken more than three days to rise from normal flow to extreme flood peaks and have taken longer to subside. During the flood of March 1936 the Connecticut had a rate of rise of about 4 inches per hour and remained at flood stage for about 7 days. This flood crested about 34 feet above normal water levels. (Woodard-USGS) W72-01157

OROHYDROGRAPHIC INCONSISTENCIES' IN THE RELIEF OF THE SOVIET FAR NORTHEAST (OB OROGIDROGRAFICHESKIKH NESOGLASIYAKH' V REL'YEFE KRAYNEGO SEVERO-VOSTOKA SSSR),

For primary bibliographic entry see Field 02A. W72-01159

COMPUTATION OF SUBSURFACE FLOW FROM LAKE BOL'SHOY ALAGEL' BY THE WATER-BALANCE METHOD (RASCHET POD-ZEMNOGO STOKA IZ OZERA BOL'SHOY ALAGEL' METODOM VODNOGO BALANSA), For primary bibliographic entry see Field 02H. W72-01162

EFFECT OF PERIOD OF RECORD ON FLOOD PREDICTION.

Barr Engineering Co., Minneapolis, Minn.

ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY 11, Paper 8525, p 1853-1866, November 1971. 7 fig, 5 tab, 9 ref.

Descriptors: \*Flood forecasting, \*Hydrographs, \*Data processing, \*Frequency analysis, Gaging stations, Hydrologic data, Rainfall-runoff relation-

Identifiers: Flood frequency, Frequency curves.

One long-term gaging station record was analyzed by standard methods, breaking the record into 205 shorter periods. Floods predicted on basis of different 10 yr periods vary by as much as 595%. The primary advantage of the log-Pearson type III method of frequency curve determination is its mathematical objectivity. Once the method of analysis is selected a given set of data gives only one answer. The objectivity, however, is also a disadvantage in that anomalous points can greatly distort the result without the user being aware of the situa-tion. Furthermore, the precision of the answer from a given set of data gives an unwarranted feeling of confidence in the accuracy of the answer. Use of the graphical method of frequency curve determination is justified when there is a long enough record so that only a moderate extrapolation is needed to reach the desired probability of occurrence. The graphical method has advantages rence. The graphical method has advantages because of its simplicity, because of the necessity to plot the data and because it is possible to use individual judgment. The graphical method is especially adaptable for design of minor structures. The mathematical method does not appear to give more accurate results than the conventional graphical method. (Knapp-USGS) W72-01166

THE DYNAMICS OF THE POPULATION SIZE OF THE LAKE SEVAN KHRAMULYA WITH LOWERING OF THE LEVEL OF THE LAKE, (IN RUSSIAN),

Tr Mol Uch Vses Nauch-Issled Inst Morsk Ryb Khoz Okeanogr. 1. 135-155. 1969. Identifiers: Conservation, Dynamics, Khramulya, Lake, Lowering, Population, Sevan, Size, USSR.

When the level of the lake is lowered, the size of the khramulya population decreases. However, it is noted that there is a more or less productive generation. The reduction in stocks is determined by the deterioration of the conditions for reproduction and the survival rate of the young in the early stages of development and by the removals, which almost yearly exceed recruitment of the commer-cial stocks. Even when the population size is decreasing the catches remained high and relative-ly constant up to 1958. This is probably explained by the gradual assimilation of the previously uncaught groupings of khramulya and by an increase in their condition. Since 1958 the assimilation of new stocks has come to an end, and the catches have decreased because of a reduction of stocks. The total catches of the past 9 yr have exceeded the recruitment by almost 1,900,000 fish. There is a discussion of the measures for preservation and restoration of the khramulya stocks .-- Copyright 1971, Biological Abstracts, Inc. W72-01253

LAND RESOURCE REGIONS AND AREAS OF INDIA. Soil Conservation Research, Demonstration and

Training Center, Dehra Dun (India). S. K. Gupta, K. G. Tejwani, H. N. Matur, and M. M.

J Indian Soc Soil Sci. 18 (2): 187-198. 1970. Identifiers: Climate, India, Land, Resource, Topography, Vegetation.

Classification of land into land resource regions and areas is useful for determining the national soil and water conservation needs, organizing research and correlating the technical soil-water management guides and manuals between different states and utilizing the research experience on one place to other places of similar soil-climatic-topographic situations. The land resource region and area classification synthesizes the information about soils water, climate, topography, vegetation and land

use. India was divided in 20 land resource regions The names of the regions indicate the location and important characteristics of the regions (with respect to climate or vegetation or soil). Land resource regions were further subdivided in 186 land resource areas. Land use (e.g. forest type, irland resource areas. Land use (e.g. forest type, irrigated land, unirrigated land) was the most important criterion for subdividing a land resource region into land resource areas. For detailed planning, land resource areas are subdivided in Land Resource Units.—Copyright 1971, Biological Abstracts Inc. stracts. Inc. W72-01258

EFFECT OF SELENIUM ON GROWTH AND DEVELOPMENT OF MICROCYSTIS AERU-GINOSA KUTZ,

D. A. V. Coll., Kanpur (India). For primary bibliographic entry see Field 05G. W72-01263

ECOLOGICAL STUDIES ON THE WEEDS OF AGRICULTURAL FIELDS: I. PERSISTENCE OF PORTULACA QUADRIFIDA L. AGAINST DESICCATION, Shivaji Coll., New Delhi (India).

For primary bibliographic entry see Field 03F. W72-01302

CONTINUATION OF STUDIES ON THE HYDROLOGY OF PONDS AND SMALL LAKES, Minnesota Agricultural Experiment Station, St. Paul.

For primary bibliographic entry see Field 02H. W72-01327

SPECIAL FLOOD HAZARD INFORMATION REPORT, HOBOLOCHITTO CREEK, EAST AND WEST HOBOLOCHITTO CREEKS, PICAYUNE, PEARL RIVER CO., MISSISSIPPL Corps of Engineers, Mobile, Ala.

Army Corps of Engineers Flood Plain Report, December 1970. 16 p, 7 plate, 3 tab.

Descriptors: \*Floods, \*Flood damage, \*Flood plains, \*Mississippi, \*Project planning, Historic flood, Flood forecasting, Overflow, Design flood, Land use, Regional flood, River basin development, Stream gages.
Identifiers: \*Hobolochitto Creek (Miss), Standard

project flood.

To provide long-term planning guidelines for the safe and orderly land developments on stream floodplains in Picayune, this brief report was prepared from records of rainfall, runoff, known flood heights, and other technical data concerning the occurrence and size of floods in the area. The Hobolochitto Creek watershed drains a 355 sq mi area. East and West Hobolochitto Creeks join north of Picayune to form the main stem which flows through the city and joins East Pearl River 3 mi southwest of Picayune in a dense swamp area. Hobolochitto Creek averages 100 ft in width and the banks are 10 ft high; the channel has sand bars and snags. Controlling depth is 1 ft during most of the yr. The greatest known flood occurred in July 1916; other historic floods occurred in May 1874 April 1900, June 1928, December 1961, and April 1964. Available data indicate that low-lying areas are inundated several times annually and serious flooding occurs about once in 4 or 5 years. Mean annual rainfall is about 60 inches. Maps, profiles, cross sections, tables, and descriptive material relating to past flooding and potential flooding are presented. (Lang-USGS)

FLOOD PLAIN INFORMATION, WEST BRANCH ROCKY RIVER, CUYAHOGA AND LORAIN COUNTIES, OHIO. Corps of Engineers, Buffalo, N.Y.

Army C February

Descripte plains, \* Flood co Identifier Regional

Flooding described in planni lands. M material floods wh available heights as 14 miles of the Ro East Braz Within th city of N and the vi Cuyahoga Lorain C average c ing an Int Velocities bined wit generally life and pr W72-013

REDUCT FLOWS I Denver, C L. Rice. ASCE Pro Drainage 469-482,

Descripto \*Peak dis Rainfall-ru analysis. Storm dra Identifiers

Roof-top p urban stor of runoff areas to p noff to the reduced. are used in pact of ne system. Ef features re fall charac relatively volved hav necessary relationshi of rainfall: napp-USG W72-0142

SOME GE AFRICAN London Sc (England); Geography For primar W72-0144

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## WATER QUANTITY MANAGEMENT AND CONTROL—Field 04

# Control of Water on the Surface—Group 4A

Army Corps of Engineers Flood Plain Report, February 1971. 49 p. 18 fig, 12 plate, 8 tab.

Descriptors: \*Floods, \*Flood damage, \*Flood plains, \*Ohio, Regional flood, Flood forecasting, Flood control, Historic flood, Peak discharge. Identifiers: \*Floods (Cuyahoga and Lorain Coun-ties Ohio), Standard Project Flood, Intermediate Regional Flood.

Flooding in Cuyahoga and Lorain Counties, Ohio is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections and other material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. The study covers 14 miles of inundated areas along the West Branch of the Rocky River from its confluence with the East Branch to the Lorain-Medina County line. Within the study area, the stream flows through the city of North Olmsted, the township of Olmsted, and the villages of Olmsted Falls and West View in Cuyahoga County and the township of Columbia in Lorain County. During periods of high water, average channel velocities vary from about four to eight feet per second through the study area. During an Intermediate Regional or Standard Project Flood, velocities would be somewhat greater. Velocities greater than three feet per second comresources greater than three feet per second combined with depths of three feet or greater are generally considered hazardous and dangerous to life and property. (Woodard-USGS) W72-01378

REDUCTION OF URBAN RUNOFF PEAK FLOWS BY PONDING,
Rice (Leonard) Consulting Water Engineers,

L. Rice. ASCE Proceedings, Journal of the Irrigation and Drainage Division, Vol 97, No IR3, Paper 8351, p 469-482, September 1971. 5 fig, 7 tab, 3 ref, ap-

Descriptors: \*Water storage, \*Flood control, Descriptors: "Water storage, "Flood control, \*Peak discharge, \*Urbanization, "Storm runoff, Rainfall-runoff relationships, Depth-area-duration analysis, Routing, Hydrographs, Flow control, Storm drains, Cities. Identifiers: \*Urban hydrology.

Roof-top ponding and short-term on-site detention storage can be incorporated into the design of urban storm drainage facilities. By limiting the rate of runoff from flat roofs and other applicable flat areas to predetermined rates, the peak rate of ruareas to predetermined rates, the peak rate of runnoff to the receiving storm drainage system can be reduced. On-site detention ponding can also be used to reduce peak runoff rates. These techniques are used in the Denver region to minimize the impact of new developments on the storm drainage system. Effective design of ponding and detention features requires careful analysis of regional rainfall characteristics. Because storage volumes are relatively small and the runoff hydrographs involved have short time bases with steep peaks, it is necessary to consider the magnitude-frequency relationship and intensity-duration characteristics of rainfall as well as its geographic distribution. (Knapp-USGS) W72-01421

SOME GEOGRAPHICAL ASPECTS OF WEST AFRICAN DEVELOPMENT, London School of Economics and Political Science

(England); and London Univ., (England). Dept. of Geography. For primary bibliographic entry see Field 06B. W72-01445

HERBICIDAL CONTROL OF CROTON. Agricultural Research Service, Beltsville, Md. rops Research Div. A. J. Oakes.

Turrialba. Revista interamericana de ciencias agricolas. July-September 1970. Vol 20, No 3, p 299-301, 1 tab, 6 ref.

Descriptors: \*Herbicides, \*Weed control, \*Weeds, \*Foliar applications, \*Spraying, Tropical regions, Poisons, Toxicity, Livestock, Pastures, Foliar, Virgin Islands, Poisonous plants, On-site investiga-tions, Sierozems.

Croton species are tropical and seriously noxious weeds, dominant throughout the U.S. Virgin Islands. Some plants are toxic to livestock. Croton is adapted to dry soils in pastures and wastelands. Field trials were conducted for herbicidal control of Croton. Foliar applications of mixed herbicides and herbicides applied in diesel-oil-water emulsion were effective. Most effective weed control resulted with solution applied to plants in complete foliage as a drenching spray. (Popkin-Arizona) W72-01457

OBSERVATIONS ON THE FUNCTIONAL ACTION OF DICAMBA (2-METHOXY-3, 6 DICHLOROBENZOIC ACID) IN CYPERUS

Instituto Agronomico, Campinas, (Brazil). Section of Plant Physiology.

A. C. Magalhaes. Turrialba. Revista interamericana de ciencias agricolas. January-March 1970. Vol 20, No 1, p 40-44. 3 fig, 9 ref.

Descriptors: \*Weed control, \*Herbicides, \*Plant growth regulators, \*Translocation, \*Foliar application, Damages, Penetration, Leaves, Xylem, Transpiration, Root zone. Identifiers: \*Adaptation.

Purple nutsedge (Cyperus rotundus) is a difficult weed to control because of its complex growth habit and adaptability. It is a plant which causes considerable damage in large agricultural areas of the world. Several experiments are reported concerning dicamba herbicide penetration into leaves, xylem translocation, and foliar-treatment effect. Dicamba showed slow leaf penetration with its greatest concentration confined to external cells, accumulated in intercellular spaces, cell walls, or dissolved in the cuticular layers, Herbicide application inhibited xylem translocation and decreased transpiration. Plants pretreated with dicamba showed accumulation of the herbicide in the basal portion of the roots. (Popkin-Arizona) W72-01459

UNIVERSITY CREATES DESERT FARM AS MODEL FOR WORLD'S ARID AREAS, 21NEWS FROM THE HEBREW UNIVERSITY OF JERUSALEM, NO. 5-6, MAY-JUNE 1971, P. 1--14, 2 FIG. Hebrew Univ. Jerusalem (Israel). Dept. of Informa-

tion and Public Affairs.
For primary bibliographic entry see Field 03F.
W72-01461

CHEMICAL WEED CONTROL IN HORTICUL-TURAL AND FORESTRY PLANTS,

Kansas State Univ., Manhattan. Dept. of Horticulture and Forestry; and Kansas State Univ., Manhattan. Dept. of Agronomy. W. A. Geyer.

Kansas Agricultural Experiment Station, Bulletin 533, March 1970, 40 p. 9 tab, 2 fig.

Descriptors: \*Chemcontrol, \*Agricultural chemicals, \*Herbicides, \*Weed control, \*Plant growth regulators, Crop response, Mechanical control, Application methods, Rates of application, Spraying, Maintenance, Storage, Disposal, Calibrations, Ornamentals, Fruit crops, Competition, Pesticide

This bulletin provides information on the proper use of 40 herbicides for effective weed control, elimination of plant damage, and avoidance of illegal residues; common and trade names are presented. Weeds can be controoled mechanically by crop competition or sequence, and/or by herbicides. Factors influencing weed control with soil-and foliage-applied herbicides are listed. Selection, use, labeling, application rate, spray drift, equipment care, storage, and container disposal of herbi-cides are discussed. Calibration includes liquidand granular-application methods, with numerical examples. Applications on nursery, ornamentals, lawns and turf, fruit and vegetable crops, garden flowers, forests and noncroplands are reviewed. (Popkin-Arizona) W72-01463

COLLEGE SEES NEED FOR RESOURCE MANAGEMENT...THUS NEED FOR A RENEWABLE NATURAL RESOURCES DIVI-SION, Nevada Univ., Reno. Div. of Renewable Natural

Resources

Nevada Ranch and Home Review, Vol. 4, No. 7, p. 6-8, Spring 1970. 4 fig.

Descriptors: \*Education, \*Research and development, \*Management, \*Ranges, \*Environmental effects, Forests, Streams, Lakes, Hydrology, Vegeta-tion, Soil surveys, Wildlife habitats, Range manage-ment, Natural resources, Universities.

The Renewable Natural Resources Division, University of Nevada, is concerned with education, research, development and management of undeveloped areas such as rangelands, forests, streams and lakes. A master plan is developed for the Tahoe Basin, based on hydrologic, vegetation and soil studies. Improvement of wildlife habitat is advocated for rangelands. Soil surveys offer methods of interpreting species distribution. Environmental effects on quality are emphasized. (Popkin-Arizona) W72-01467

STUDY AND UTILIZATION OF THE WATER RESOURCES OF THE USSR, 1966-1967, (IZUCHENIYE I ISPOL'ZOVANIYE VODNYKH RESURSOV SSSR, 1966-1967 GG). Akademiya Nauk SSSR, Moscow. Inst. of Water

Research. For primary bibliographic entry see Field 02A.

W72-01549

STORM SEWER GRANT AIDS SEWER IM-PROVEMENTS.

Richmond Dept. of Public Works, Calif. C. E. Dalgleish. Public Works, Vol. 102, No. 9, p 86-87, September 1971. 1 fig, 1 photo.

Descriptors: \*Storm drains, \*Sewers, \*Storm runoff, \*Drainage, \*Drainage systems, \*Flooding. Identifiers: \*Richmond, California, Model cities, Department of Housing and Urban Development.

The lack of a storm drainage system has caused the City of Richmond, California severe drainage problems. Surface drainage facilities and a few segments of storm sewer can deal with minor drainage problems, but the lack of interceptors to carry off runoff from concentration points of water has led to localized flooding. In late 1968, Richmond was selected for a Model Cities Neighborhood Grant. Storm drainage improvements are necessary to comply with the program. In September 1970, Richmond received a grant of \$932,400 from the Department of Housing and Urban Development. The grant is to fund the building of storm drains, but will also permit the construction of a major railroad-street grade separation and improvements of a major cross-town street. (Strachan-Chicago) W72-01571

## Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

# Group 4A-Control of Water on the Surface

OPTIMAL CAPACITY OF PORT LOADING FACILITIES,
Virginia Polytechnic Inst. and State Univ.,

Blacksburg. Dept. of Economics. L. S. Case, and L. B. Lave.

Water Resources Research, Vol. 7, No. 5, p. 1323-1327, October 1971, 4 tab, 2 ref.

Descriptors: \*Optimization, \*Docks, \*Ships, \*Queueing theory, \*Cost-benefit analysis, Poisson ratio, Distribution, Temporal distribution. Identifiers: \*Chicago barge terminals.

This paper discussed the method of determining the loading capacity of port facilities when vessel arrival and service times are random. When arrival times (assumed to have a Poisson distribution) and service times (assumed to be exponentially distributed) are random, queueing theory can determine the average waiting time for an individual cargo vessel as a function of the arrival and service distributions, the capacity of the terminal facility, and the arrival rate. Terminal capacity must be expanded to save waiting time for a vessel. The trade off of additional capital cost of a dock against the value of the saved vessel time determined the optimal capacity of a loading facility. Estimates were made of the costs of constructing additional facilities and of keeping a vessel waiting. Also considered were the effects of seasonality in traffic on the decision of when to expand a facility and the effects of speeding the service rate at an existing dock. The authors concluded that dock capacity is optimized by expanding the facility whenever the cost of an additional dock is less than the value of the savings in delays. (Markell-Cornell) W72-01574

11TH TECH MEETING OF THE INTERNAT'L UNION FOR NATURE CONSERVATION AND NATURAL RESOURCES, 1ST AND 2ND SESIONS. COMMISSION ON ECOLOGY SECTION ON CONSERVATION IN LAND USE PLANNING, SOIL AND H2O RESOURCES, ESPECIALLY IN MT REGIONS, WILDLIFE RESOURCES, AND FORESTRY. NEW-DELHI, INDIA, NOVEMBER 25-28, 1970,

F. Bouliere.

Publ N S. 17: 1970. 13-76. (See also W72-01597

and W72-01598).

Identifiers: Commission, Conservation, Ecology, Forestry, India, International, Land, Meeting, Mountain, Natural, Nature, Nd. New-Delhi, Planning, Resources, Section, Sessions, Soil, St. Symposium, Technical, Th, Union, Water, Wil-W72-01596

SOME RECENT STUDIES OF ECOLOGICAL EFFECTS OF MONTANE WATER STORAGE IN THE UNITED KINGDOM,

J. Berry.
IUCN (Int Union Conserv Nature Natur Resour) Publ N S. 17: 1970. 35.

Identifiers: Discharge, Ecological, Lake, Montane, Storage, United-Kingdom, Water. W72-01597

SOME RECENT STUDIES OF ECOLOGICAL EFFECTS OF MONTANE WATER STORAGE IN THE UNITED KINGDOM.

IUCN (Int Union Conserv Nature Natur Resour) Publ N S. 17: 1970. 36-43.

Identifiers: Conservation, Ecological, Fish, Montane, Natural, Resource, Storage, United-Kingdom,

W72-01598

VIEW OF THE ROLE OF THE FOREST IN WATER ECONOMY,

G. Aussenac.

Rev Forest Fr (Nancy). 22 (6): 1970. 603-618. Identifiers: Ecology, Economy, Forest, Precipita-tion, Transpiration, Watershed. W72-01637

PHYSICAL PROCESSING CHARACTERISTICS OF SOME AQUATIC MACROPHYTES AS RE-LATED TO MECHANICAL HARVESTING, Wisconsin Univ., Madison. Water Resources

For primary bibliographic entry see Field 05C. W72-01640

# WATER RESOURCE PROJECTS OF THE CORPS OF ENGINEERS.

Hearing--Subcomm on Flood Control--Rivers and Harbors--Comm on Public Works, US Senate, 92d Cong, 1st Sess, July 28, 1971. 43 p, 4 tab.

Descriptors: \*Flood control, \*Channel improve-ment, \*Economic efficiency, \*Federal govern-ment, Government finance, Administrative agen-cies, Rivers, Harbors, River basin development, Legislation, Construction costs, Cost-benefit ratio, Water resources development, Navigation, Levees, Floodways, Ships, Recreation, Fisheries, Dredging, Indian reservations, Land reclamation, Cities. Identifiers: \*Flood Control Act.

The purpose of the hearing was to receive testimony from the Army Corps of Engineers respecting present and future flood control projects. The Director of Civil Works testified concerning the status of river basin development projects in light of critical monetary limitations. He stressed the need for additional authorizations beyond that in the 1936 and 1938 Flood Control Acts. Deficiencies in nine river basin projects total \$201 million and will increase at the end of 1973 to \$628 million for 14 basin projects. The Deputy Director of Civil Works spoke about section 201 projects under the 1965 Flood Control Act. Testimony disclosed that the Galveston harbor and channel require deepening. The Subcommittee investigated adverse consequences of channel im-provement and received environmental statements from several federal agencies. Testimony disclosed that no federal projects exist on the Frio River in Texas where flood control protection is urgently needed. Environmental statements from federal agencies were received. Testimony disclosed the Mississippi River at Winona, Minnesota and Mur-rells inlet in South Carolina required improvements. Testimony was received concerning the Crow Creek Sioux Reservation's needs, and a request for additional funding was considered. (Rees-Florida) W72-01675

POWERS OF STATE UNDER ORDINANCE OF 1787 IN RESPECT OF NAVIGABLE WATERS. For primary bibliographic entry see Field 06E. W72-01676

#### 4B. Groundwater Management

TECHNIQUES FOR GROUNDWATER IN-VESTIGATION IN DRAINAGE SURVEYS IN THE PUNIAB.

Punjab Agricultural Univ., Ludhiana (India). Coll. of Agricultural Engineering.

S. D. Khepar. J Res Punjab Agr Univ. 7 (2): 248-261 Illus 1970. Identifiers: Drainage, Ground, India, Punjab, Survey, Techniques.

The details of procedures and techniques are presented. The techniques are, in general, applica-ble to the irrigated lands in the arid and semiarid regions. The techniques for installing the piezometers and observation wells, and the equipment required for conducting the studies were also developed. The procedure for collection, analysis and interpretation of data are described.--Copyright 1971, Biological Abstracts, Inc. W72-01234

Tr Darvinskogo Gos Zapovednika. 9. 5-42. 1968.

Identifiers: Atmospheric, Characteristic, Darwin, Forests, Ground, Pattern, Precipitation, Regime, Reserve, Slope, Soil, Types, USSR, Vegetation.

Changes in the groundwater regime on the shores of the Rybinsk Reservoir depend upon the height of shores, the steepness of slopes and the nature of the vegetation. Bogging proceeds rapidly on low (A100 cm) shores under forest vegetation. Changes in the height of groundwater tables depend upon the amount of atmospheric precipitation and the water losses by soil and vegetation. Only within a narrow strip, 50 to 100 m wide, is the height of groundwater tables mainly determined by the water level in the reservoir.—Copyright 1971, Biological Abstracts. Inc. Changes in the groundwater regime on the shores stracts, Inc. W72-01256

ANALYSIS OF GROUND AND SURFACE WATER UTILIZATION IN URBANIZED ARID AREAS, Nevada Univ., Reno. Center for Water Resources

Research.

G. F. Cochran, J. C. Ohrenschall, and W. C.

Available from the National Technical Information Available from the National Technical Information Service as PB-204 492, \$3.00 in paper copy, \$0.95 in microfiche. Technical Report Series H-W, Hydrology and Water Resources Publication No 8, January 1970. 81 p, 18 fig. 38 tab, 45 ref, 2 append. OWRR C-1337 (No 1970) (1).

Descriptors: \*Urbanization, \*Water resources development, Legislation, Economics, \*Arid lands, Optimization, \*Costs, \*Forecasting, \*Water utilization, Nevada, \*Optimium development plans, Model studies, Human population, \*Con-

junctive use. Identifiers: \*Las Vegas Valley (Nev).

Urbanization in arid regions has been accelerating at a tremendous rate. This type of growth has taken place in the Las Vegas Valley in Southern Nevada and will likely continue elsewhere as the country's and will likely continue elsewhere as the country's population expands. This report's purpose is to examine some of the many facets of water resources developments which have occurred to support the growth in the Las Vegas Valley, with the ultimate objective of optimizing the entire water resource system. The history and scorping of the second system. The history and economy of the area are dealth with in detail. Estimates of current and future value of water are made, with projections of future population growth and water requirements. Laws and institutions developed to control and manage the area water resources are examined. Potential legal problems are presented and discussed. Physical characteristics of the area's water resources and water production systems are described. Mathematical models are developed which relate water costs to system usage and response. Finally an optimization routine is formulated to integrate the legal, institutional, economic, and physical characteristics of the entire system. The optimization routine is then exercised to examine effects on water production costs of changes in legal and institutional parameters. The entire ef-fort is devoted to utilization of an interdisciplinary approach to develop a rational and effective tool for the planning, developing and managing of con-junctive use systems in arid regions. (Bell-New-W72-01333

MATHEMATICAL MODELING OF FRESH-WATER AQUIFERS HAVING SALT-WATER BOTTOMS,

General Electric Company, Santa Barbara, Calif. Tempo.

For primary bibliographic entry see Field 02F. W72-01342

EXOTIC USES OF AQUIFERS,

Louisiana State Univ., Baton Rouge. Dept. of Civil Engineering.

ASCE Proceedings, Journal of the Irrigation and Drainage Division, Vol 97, No IR 3, Paper 8352, p 515-522, September 1971. 2 fig, 15 ref.

Descripto managem \*Injection character Drawdow Identifier

Groundwa monitor a junctive ( the use of tion of say mining of ing, and removes a pair the r formation complishe program i detect the supply be USGS) W72-014

A RECO WATER SOUTHE Geologica K. L. Dyer Geologica p, 5 fig, 3 Descripto

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GROUND GOMERY Geologica B. P. Popk Texas Wa November

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Descriptor \*Groundw Aquifer ch lections, V recharge, Pumping, levels, Spe Identifiers gomery Co

# WATER QUANTITY MANAGEMENT AND CONTROL-Field 04

## Effects on Water of Man's Non-Water Activities—Group 4C

Descriptors: \*Water pollution sources, \*Water management (Applied), \*Aquifers, \*Groundwater, \*Injection wells, Waste disposal, Landfills, Aquifer characteristics, Water quality, Monitoring, Mining, Identifiers: Aquifer management.

Groundwater basin managers must be prepared to monitor and counteract potential hazards to conjunctive operation of groundwater basins. These hazards arise from legitimate activities, including the use of wells for disposal of liquid wastes, opera-tion of sanitary land fills, storage of gas in aquifers, mining of valuable minerals that involves dewatering, and the mining of sand and gravel (that removes a part of the aquifer) which may also impair the recharge capability of the water-bearing formation. All of these activities may be safely accomplished within a groundwater management program if provisions are made for monitoring to detect the impact of such activities on the water supply before deleterious effects occur. (Knapp-USGS) W72-01422

# A RECONNAISSANCE OF THE QUALITY OF WATER FROM IRRIGATION WELLS AND SPRINGS IN THE SNAKE PLAIN AQUIFER, SOUTHEASTERN IDAHO,

Geological Survey, Boise, Idaho. K. L. Dyer, and H. W. Young. Geological Survey Open-file Report, July 1971. 29 p. 5 fig. 3 tab, 5 ref.

Descriptors: \*Water quality, \*Irrigation wells, \*Springs, \*Idaho, Data collections, Groundwater basins, Testing, Chlorides, Nitrates, Water temperature, Aquifers.

Identifiers: \*Snake Plain aquifer, Orthophosphate

The water quality in part of the Snake Plain aquifer is described based on analyses of water samples collected in 1970. Chloride, nitrate, and orthophosphate concentrations, specific conductance, and temperature were measured for sam-ples collected from 194 irrigation wells and 29 springs. Standard complete analyses were made of samples from 55 of the irrigation wells and 13 of the springs; 46 of the irrigation wells were tested for fecal coliform bacteria. Although minor fluctuations in some constituents were noted, no welldefined seasonal trends were identified. Chloride concentrations in the samples collected ranged from 7 mg/liter (milligrams per liter) to 325 mg/liter, although in the heavily irrigated areas most concentrations ranged from 10 to 160 mg/liter. Nitrate concentrations ranged from 2 to 32 mg/liter and have an areal distribution very similar to that of specific conductance and chloride. Concentrations of orthophosphate ranged from 0 to 0.23 mg/liter, although generally they were below 0.1 mg/liter. Groundwater tempera-tures in June and July ranged from 10.0 deg C (deg Celsius) to 20.0 deg C and averaged 12.4 deg C. No fecal coliform were found in the water from 46 irrigation wells tested for these bacteria. (Lang-USGS) W72-01423

#### GROUNDWATER RESOURCES OF MONT-GOMERY COUNTY, TEXAS,

Geological Survey, Austin, Tex. B. P. Popkin.

Texas Water Development Board Report 136, November 1971. 149 p, 29 fig, 11 tab, 50 ref.

Descriptors: \*Water resources development, \*Groundwater, \*Aquifers, \*Water supply, \*Texas, Aquifer characteristics, Hydrologic data, Data col-lections, Water yield, Water quality, Groundwater recharge, Water users, Hydrogeology, Water wells, Pumping, Withdrawal, Chemical analysis, Water levels, Specific capacity. Identifiers: \*Groundwater resources, \*Mont-

gomery County (Tex).

Groundwater in Montgomery County, Texas is contained in sands of the Catahoula Sandstone, lower part of the Jasper aquifer, upper part of the Jasper aquifer, Burkeville aquiclude, Evangeline aquifer, and Chicot aquifer. The Chicot, Evangeline, and upper part of the Jasper contain fresh water throughout the county. The Catahoula Sandstone and lower part of the Jasper contain fresh and slightly saline water in the northern and central parts of the county. The Evangeline transmits about 10 mgd and the upper part of the Jasper transmits about 3.5 mgd. The water can be used for most purposes. About 80 million acre-feet of fresh groundwater is in storage in Montgomery County. However, most of this water cannot be economically produced. About 65 mgd could be obtained with pumping levels not exceeding 400 feet along an assumed line of discharge in the latitude of Conroe. As much as 150 mgd could be pumped with only moderate water-level declines and land-surface subsidence. If the rejected recharge in the outcrop area were salvaged, an additional 140,000 acre-feet per year (125 mgd) of water would be available. (Woodard-USGS) W72-01427

# GROUNDWATER RESOURCES OF RENVILLE AND WARD COUNTIES,

Geological Survey, Bismarck, N. Dak For primary bibliographic entry see Field 02F. W72-01431

# AN APPRAISAL OF GROUND WATER FOR IR-RIGATION IN THE WADENA AREA, CENTRAL MINNESOTA, Geological Survey, Washington, D.C.

Available from Sup Doc, GPO, Washington, D C 20402 - Price \$5.00. Geological Survey Water-Supply Paper 1983, 1970. 56 p, 25 fig, 12 plate, 3 tab, 21 ref.

Descriptors: \*Water resources development, \*Groundwater, \*Water demand, \*Irrigation, \*Min-nesota, Hydrologic data, Data collections, Withdrawal, Drawdown, Water yield, Water quali-ty, Chemical analysis, Groundwater recharge, Aquifers, Aquifer characteristics, Transmissivity, Hydrographs, Analog models, Water level fluctua-

Identifiers: \*Wadena area (Minn).

The Wadena area is part of a large sandy plain in central Minnesota whose soils have low water-hold-ing capacity. Drought conditions which adversely affect plant growth frequently occur in the summer when moisture is most needed. Supplemental irrigation is increasing. The groundwater resources were evaluated to determine possible effects of development. About half the area's approximately 102,000 acres is considered irrigable at the present time. In 1967, about 1,000 acres were under irrigation. Outwash sand and gravel, which forms the water-table aquifer, is the main source of water. Saturated thickness ranges from 0 to 70 feet and averages about 36 feet. Groundwater availability is greatest in alluvial deposits on the flood plain of the Leaf River. Transmissivity of the water-table aquifer in most of the study area ranges from 15,000 to 120,000 gpd per ft. In approximately 60% of the area, the water-table aquifer should be capable of supplying more than 300 gpm to a well for an assumed pumping period of 30 days if draw-down in the pumped well is two-thirds the saturated thickness after correction for dewatering. (Woodard-USGS) W72-01432

#### POTENTIAL POLLUTION OF THE OGALLALA BY RECHARGING PLAYA LAKE WATER,

Texas Tech Univ., Lubbock. Water Resources Center For primary bibliographic entry see Field 05B. W72-01462

HYDROGEOLOGY OF THE NISHNABOTNA RIVER BASIN, lowa State Univ. of Science and Technology,

Ames. Dept. of Earth Science. For primary bibliographic entry see Field 02F. W72-01520

# 4C. Effects on Water of Man's Non-Water Activities

# HYDROLOGIC EFFECTS OF DEFORESTING TWO MOUNTAIN WATERSHEDS IN WEST

VIRGINIA, Forest Service (USDA) Parsons, W. Va. Northeastern Forest Experiment Station. J. H. Patric, and K. G. Reinhart.

Water Resources Research, Vol 7, No 5, p 1182 1188, October 1971. 1 fig. 4 tab, 23 ref.

Descriptors: \*Clear-cutting, \*Forest managemen Water yield, Vegetation effects, Rainfall-runol relationships, Land clearing, Watershed manage ment, West Virginia, Water yield improvemen Runoff, Evapotranspiration, Water balance. Identifiers: Fernow Experimental Forest (W Va).

The upper half of one watershed and the lower ha of another were deforested and maintained barre from 1965 to 1967. Forest on the remaining halve was cut in 1968. Water yield increases from bot watersheds averaged almost 6 inches during th half deforested stage and rose to over 10 inch after complete deforestation. The duration of tl flows greatly increased on both watersheds. Oth hydrologic effects (instantaneous peak flow stream temperature, specific conductance, and to bidity) were greater on the lower half deforest watershed. Forest cutting causes substantial creases in streamflow, and these studies provsome values of hydrologic effects of complete forestation. (Knapp-USGS) W72-01128

# CLEAR-CUT LOGGING AND SEDIM PRODUCTION IN THE OREGON CC

RANGE, Oregon State Univ., Corvallis. School of Fore G. W. Brown, and J. T. Krygier.

Descriptors: \*Sediment yield, \*Clear-c \*Erosion, \*Forest management, Sedimen Forestry, Lumbering, Soil conservation, Ra runoff relationships, Oregon, Road constructi Identifiers: Coast Range (Oregon).

The impact of road construction, two pattern clear-cut logging, and controlled slash burning the suspended sediment yield and concentrafrom three small watersheds in the Oregon Co Range was studied for 11 years. Sediment prod tion was doubled after road construction but beflogging in one watershed and was tripled a burning and clear-cutting of another waters! Felling and yarding did not produce statistically nificant changes in sediment concentration. Va tion in the relation between sediment concen tion and water discharge on small undisturl streams was large. (Knapp-USGS) W72-01129

# CHANGES IN WATER YIELD FOLLOWIN PARTIAL FOREST COVER REMOVAL ON A

EXPERIMENTAL WATERSHED, Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources. For primary bibliographic entry see Field 03B. W72-01414

#### Field 04-WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4C—Effects on Water of Man's Non-Water Activities

VEGETATION CONVERSION AND CHANNEL GEOMETRY IN MONROE CANYON, SOUTHERN CALIFORNIA, California Univ., Los Angeles. Dept of Geography; and Forest Service (USDA), South Lake Tahoe,

A. R. Orme, and R. C. Bailey. Association of Pacific Geographers, Yearbook, Vol 33, p 65-82, 1971. 12 fig, 3 ref.

Descriptors: \*Watershed management, \*Channel morphology, \*Vegetation effects, \*Chaparral, \*Soil stability, Hydrology, Debris avalanches, On-site investigations, Runoff, Streamflow, Sediment load, California, Canyons, Channel flow, Ecosystems. Identifiers: \*Grass seeding.

Studies of the adjustments of channel geometry to hydrological fluctuations linked to physical factors are common, but studies in which changes in vegetation cover are related to alteration of variables affecting channel geometry are rare. Monroe Canyon, situated along the margins of the San Dimas Experimental forest was placed under intensive management in 1958 in an effort to increase water yield. The original geomorphology, stream hydrology, vegetation and climate of the canyon are described. In 1958 and 1959, 17 ha of riparian woodland were removed from the canyon floor. In 1960, a lightning fire consumed almost all of the chaparral vegetation of the slopes. After the fire, a portion of the watershed was sprayed with herbi-cides and a seeded annual grass cover was established on 57 ha of slopeside while the remaining area was allowed to revert to chaparral. The riparian woodland clearance resulted in decreased transpiration and increased streamflow. The areas converted to grass experienced greater soil insta-bility and slippage and decreased interception, resulting in greater runoff. In subsequent years, stream discharge rates and sediment loads evidenced remarkable fluctuations and after the rainy seasons the canyon became clogged with debris. Not only were changes in the longitudinal profile noteworthy, but changes in the cross-channel profile were quite spectacular, particularly where less cohesive materials margined the channel. Today the channel survives as a debris-filled relict feature. It is concluded that the channel's capacity for self-regulation was destroyed. (Casey-Arizona) W72-01451

# 4D. Watershed Protection

HYDROLOGY AND EROSION OF LOESSIAL WATERSHEDS,

Agricultural Research Service, Columbia, Mo. Soil and Water Conservation Research Div. K. E. Saxton, R. G. Spomer, and L. A. Kramer. ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY 11, Paper 8523, p 1835-1851, November 1971. 9 fig, 3 tab, 17 ref.

Descriptors: \*Soil erosion, \*Rainfall-runoff relationships, \*Loess, \*Vegetation effects, \*Sediment yield, Iowa, Sedimentation, Gully erosion, Gullies, Soil conservation.

Five agricultural watersheds in the Missouri Valley deep loess soils region in western Iowa were instrumented to determine their hydrology, gully erosion, and surface erosion. Two watersheds (75 and 83 acres) were singly cropped in contoured corn, another (150 acres) in level-terraced corn, and a fourth (107 acres) in pastured grass. A fifth watershed (389 acres) was level terraced with varied cropping. Average annual stream flow (1964-1969) from the level-terraced corn watershed was almost identical with the 7.5 inches from the contoured corn watersheds; but 86% was base flow, compared with only 32% from the contoured areas. Total streamflow from the grass watershed was 60% of that from the corn watersheds. Peak rates from the grassed and levelterraced watersheds have been less than 10% of those from the contoured watersheds which ranged up to 5.84 inches per hr. Measured suspended sedi-ment, derived from both gully and surface erosion, was 38 tons per acre per yr and 30 tons per acre per yr from the two contoured-corn watersheds, but the grassed and level-terraced corn waterheds had only 0.8 tons per acre per yr and 0.9 ton per acre per yr, respectively. (Knapp-USGS) W72-01165

EFFECT OF EROSION-CONTROL SOWING TECHNIQUES ON SOIL EROSION MOISTURE, (IN UKRAINIAN),

I. I. Bilozer, and S. M. Donets' Zemlerobstvo Respub Mizhvid Temat Nauk Zb. 15, 36-42, 1968. Russian summary. 15. 36-42. 1968. Russian summary. Identifiers: Control, Erosion, Furrow, Moisture, Pidge Soil. Sowing, Techniques, Wheat-M, Ridge, Soil, Sowing, Techniques,

The most effective sowing techniques on mediumeroded chernozems on slopes with an 8 degree gradient were furrow and ridge sowing. They reduced erosion by 1/2 to 2/3 compared to ordinary sowing across the slope, increased moisture accumulation by 16 mm in the 0-150 cm layer and improved the yield of winter wheat by 270-480 kg/ha.—Copyright 1971, Biological Abstracts, Inc. W72-01208

THE GULLY EROSION PATTERN AROUND THE BASHMAKOVO AND POIMA AREAS AND ITS CONTROL (IN RUSSIAN), N. A. Mardenskii, and A. P. Sorochinskii.

Geogr Sb Penz Otd Geogr Obshchest SSSR. 1. 120-126, 1968.

Identifiers: Bashmakovo, Control, Erosion, Gully, Pattern, Poima, USSR.

Over the last 100 yr the gullies have grown longer (by about 200 m) and wider. Valley slopes and bot-(by about 200 m) and wider. Valley slopes and bottoms are currently affected by gully formation processes, which are more vigorous on sunny slopes. There are no fresh gullies on forested slopes. In the control of gully formation, the local geographical conditions involved must be considered.—Copyright 1971, Biological Abstracts, loc.

W72-01238

V. D. Savichev.

Byull Vses Nauch-Issled Inst Agrolesomelior. 3.55.

32-34. 1968. English summary. Identifiers: Ash-D, Box, Chernozen, Chestnut, Control, Dark, Elder-D, Elm-D, Erosion, Green, Hydrophysical, Oak-D, Pedunculate, Shelterbelts, Soils, Washed.

In a dark-chestnut loamy solonetsous medium-washed soil of the Middle Don under a shelterbelt (box-elder, common elm, green ash, pedunculate oak) for 30 yr, 6-7 cm increase in the thickness of the humus horizon, an 0.8% increase of humus, a 27 cm subsidence of the carbonate boundary, and a 3-4 fold increase of the content of medium and large aggregates and water permeabilities occurred. These soils shifted to an intermediate position from dark-chestnut solonetsous soils to ordinary chernozym.--Copyright 1971, Biological Abstracts. Inc. W72-01257

CONTROL OF SOIL EROSION AND PROTEC-

TIVE AFFORESTATION, S. V. Vasilevskaya, and S. I. Samanchuk. Kuibyshev Knigoizdat: 1968. 316 p. Identifiers: Af, Control, Erosion, Forestation, Protective, Soil

Soil erosion in the Kuibyshev Region, control measources coning for protective afforestation, the selection of suitable trees and shrubs and the distribution and planting patterns for protective stands, and the technology of protective afforestation are discussed.—Copyright 1971, Biological Abstracts, Inc. W72-01269

VEGETATION CONVERSION AND CHANNEL GEOMETRY IN MONROE CANYON, SOUTHERN CALIFORNIA, California Univ., Los Angeles. Dept of Geography; and Forest Service (USDA), South Lake Tahoe,

For primary bibliographic entry see Field 04C. W72-01451

APPALACHIAN LAND STABILIZATION AND CONSERVATION PROGRAM. For primary bibliographic entry see Field 06E. W72-01648

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### 05. WATER QUALITY MANAGEMENT AND PROTECTION

# 5A. Identification of Pollutants

PREOPERATIONAL RADIOLOGICAL SUR-VEILLANCE OF THE FLORIDA POWER COR-PORATION'S CRYSTAL RIVER POWER REAC-

TOR SITE, Florida State Div. of Health, Orland. Radiological and Occupational Health Section.
For primary bibliographic entry see Field 05B.
W72-01154

MICROBIOLOGY OF FOODS: VI. SALMONEL-LAE IN MEAT AND LYMPH GLANDS OF SLAUGHTERED HORSES. BACTERIOLOGY OF WATER AND RESIDUAL FLUIDS (IN

Buenos Aires Univ. (Argentina). Facultad de Agronomia y Veterinaria. For primary bibliographic entry see Field 05B. W72-01227

STATISTICAL CORRELATIONS BETWEEN TOTAL COLIFORM AND ENTEROCOCCUS COUNTS IN WATER SUPPLY OF TARAI RE-GION.

Uttar Pradesh Agricultural Univ., Naini Tal (India). Coll. of Veterinary Medicine. D. C. Thapliyal, Sartaj S. Ahluwalia, M. S. Sethi,

and S. K. Negi. Ind j Med Res 58 (7): 840-844. 1970.

Identifiers: Coliform, Count, Counts, Enterococcus, India, Indicators, Number, Plate, Pollution, Probable, Standard, Statistical, Tarai.

Water samples (100) with varying pollutional loads were collected from 18 different sources in the region. These samples were analyzed bacteriologically for the Standard plate count per ml (SPC/ml), and most probable number per 100 ml (MPN/100 ml) of coliforms and enterococci. Highly significant positive correlations existed between these counts suggesting that with an increase or decrease in I count there was corresponding increase or decrease in the 2nd count. Correlation coefficient value between coliform and plate counts was highest (0.76) followed by that between coliform and enterococcus counts (0.56) and plate and enterococcus counts (0.48). Partial correlations calculated between 2 variables keeping the effect of the 3rd variable constant, revealed that the coliform count is also influenced by the factors that effect plate count. The low correlation coefficient value of 0.10 between plant and enterococcus counts suggests that the latter is perhaps more specific than coliform count. The correlation coefficient value of 0.34 between coliforms and enterococci suggests that the enterococci could probably serve as an alternative to coliforms for judging the sanitary status of the water supply.—Copyright 1971, Biological Abstracts, Inc. W72-01248

SQUARE-WAVE POLAROGRAPHIC DETERMINATION OF LEAD AS A POLLUTANT IN RIVER WATER,

Shippensburg State Coll., Pa.

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

# Identification of Pollutants—Group 5A

E. B. Buchanan, Jr., Thomas D. Schroeder, and Bozena Novosel.

Anal Chem. 42 (3): 370-373. 1970. Identifiers: Determination, Iowa, Lead, Polarographic, Pollutant, River, Square, Wave.

A square-wave polarograph was used to determine trace amounts of Pb in potable water as part of a pollution study in the vicinity of lowa City, lowa. By using a combination of sodium perchlorate and NaF as a supporting electrolyte under acidic conditions, as little as 2 plus or minus 0.32 ppb Pb could tions, as attre as 2 pius or minus 0.32 ppb Pb could be determined without preconcentration of the samples. The sensitivity of this technique is roughly 100 times that of similar methods by atomic absorption.—Copyright 1971, Biological Abstracts, Inc. W72-01250

THE SURVIVAL OF MYCOBACTERIA IN DIFFERENT SUBSTRATES OF THE ENVIRON-

MENT, (IN RUSSIAN),
For primary bibliographic entry see Field 05B.
W72-01284

CHROMATOGRAPHIC CONCENTRATION OF PESTICIDES FROM A LARGE MASS OF

East Carolina Univ., Greenville, N. C. Dept. of Biology. T. Ito

Available from the National Technical Information Service as PB-204 490, \$3.00 in paper copy, \$0.95 in microfiche. North Carolina Water Resources Research Institute, Raleigh, Report No 54, UNC-WRRI-71-54, August 1971. 12 p, 3 tab, 8 ref, append. OWRR A-050-NC (1).

Descriptors: \*Pesticides, \*Analytical techniques, \*Chromatography, Waste identification, \*Pollutant identification, Water analysis, Chemical analy-

Identifiers: \*Pesticide analysis.

In analysis of pesticide residues in water the greatest difficulty at present is the lack of a good practical method to extract and concentrate the residues from water. This report is concerned with the attempt to improve presently available methods. The method studied here was partition chromatography with 'anchored' stationary phases; that is, the stationary phases bonded chemically to a solid support. Pesticide recovery using this method was found to be unsatisfactory; however, it is believed that partition and countercurrent chromatography still offer the best methods for this pur-pose and deserve further investigation. W72-01330

THE EFFECT OF HERBICIDES, PESTICIDES, AND FERTILIZERS ON THE OPTICAL PRO-PERTIES OF WATER,
Missouri Univ., Kansas City. Dept. of Physics.

For primary bibliographic entry see Field 01B. W72-01334

A RECONNAISSANCE OF THE QUALITY OF WATER FROM IRRIGATION WELLS AND SPRINGS IN THE SNAKE PLAIN AQUIFER,

GEORGIA STATE STARKE PLAIN AQUIL SOUTHEASTERN IDAHO, Geological Survey, Boise, Idaho. For primary bibliographic entry see Field 04B. W72-01423

USE OF ULTRAVIOLET IRRADIATION IN THE

USE OF ULTRAVIOLET IRRADIATION IN THE DETERMINATION OF NUTRIENTS IN WATER WITH SPECIAL REFERENCE TO NITROGEN, Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Water Branch.

B. K. Afghan, P. D. Goulden, and J. F. Ryan.

Available from Inland Waters Br, Dept Energy, Mines and Resources, Ottawa, Ontario, Canada. Canada Department of Energy, Mines and Resources Inland Waters Branch Technical Bulletin 40, 1971. 22 p, 10 fig, 4 tab, 11 ref.

Descriptors: \*Ultraviolet radiation, \*Irradiation, Descriptors: "Otravious' radiation, "Irradiation," water analysis, "Nutrients, "Water pollution sources, Nitrogen, Organic compounds, Chemical analysis, Analytical techniques, Water chemistry, Oxidation, Hydrogen ion concentration, Chemical

The efficiency of ultraviolet irradiation to oxidize 17 different organic compounds was confirmed by oxidizing these compounds in water and by spiking oxidizing these compounds in water and by spiking the same amounts of these compounds in lake water. The percent recovery is tabulated for each organic compound tested. Only EDTA, hydrazine dihydrochloride and phenylhydrazine hydrochloride failed to give quantitative recovery. Quantitative oxidation of these compounds was achieved by catalytic oxidation using silver. A series of solutions containing different organic compounds and covering pH range 1-8 was prepared and irradiated using a 550-watt lamp. The solutions were then analyzed for nitrate-nitrite content. The results showed that certain compounds are quantitatively oxidized within a reasonable irradiation time only in acid conditions while others require an alkaline medium. Urea is quantitatively oxidized in acidic medium while the oxidation of ammonia is quantitative in alkaline medium only. Therefore, for the analysis of unknown samples, the oxidation was carried out both in acid and alkaline media prior to the determination of total nitrogen content in water. (Woodard-USGS) W72-01425

COMPUTER PROGRAMS IN USE IN THE WATER QUALITY DIVISION, VOL. 2, Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

For primary bibliographic entry see Field 07C. W72-01426

MERCURY AND OTHER HEAVY METALS IN WATER SUPPLIES, Souther (Henry) Engineering Co., Hartford, Conn.

For primary bibliographic entry see Field 05B. W72-01521

THE DETERMINATION OF MERCURY IN SOILS BY FLAMELESS ATOMIC ABSORP-

Texas A and M Univ., College Station. Dept. of Agricultural Analytical Services. Agricultural Analytical Services.
J. R. Melton, W. L. Hoover, and P. A. Howard.
Soil Science Society of America Proceedings, Vol
35, No 5, p 850-851, September-October, 1971. 1
fig. 1 tab. 5 ref.

Descriptors: \*Heavy metals, \*Soils, \*Soil chemistry, \*Flame photometry, Chemical analysis, Analytical techniques, Pollutant identification.

A method is described for the determination of mercury in soils at the ppb level or greater. A simple digestion step requires no heat. Soils from two states were studied for Hg content; recoveries of mercury added to several soils ranged from 97.0 to 102.5%. (Knapp-USGS) W72-01542

THE MICROFLORA OF SOUTHERN OHIO POULTRY LITTER, J. Lovett, J. W. Messer, and B. Read, Jr.

Poultry Science, Vol 50, No 3, May 1971, p 746-751. 7 tab. 17 ref.

Descriptors: \*Farm wastes, \*Poultry, \*Microorganisms, Ohio, Chemical analysis, Analytical techniques, Salmonella, Cultures, Coliforms, Ecoli, Molds, Fungi, Plants, \*Waste identification. Identifiers: \*Microflora, Total count, Poultry litter.

Poultry litter from four Southern Ohio farms was analyzed; the microflora was enumerated, and the fungal population was classified to genera. At each farm, litter was taken from several areas within the poultry house. Composite litter samples were ground in a Wiley mill. Three media and two incubation methods were evaluated before deciding on the total count procedure. TSA consistently yielded greater counts than either PCA or STCM. Litter pH and total bacterial and fungal counts increased with litter usage to about one month, then declined slightly and remained constant thereafter. Coliform and Escherichia coli were constant throughout the sampling period for all litter. After one week of litter use, approximately 10 per cent of the total microbial population was found to consist of coliform. Twelve fungal genera were identified from poultry feeds. A wider variety of mold genera was isolated from litter. (Parker-lowa State) W72-01555

PROPERTIES AND PUMPING CHARAC-TERISTICS OF HOG WASTES, E. P. Taiganides, T. E. Hazen, E. R. Baumann, and

H. P. Johnson.

Transactions of the American Society of Agricultural Engineers, Vol 7, p 123-124, 127, 129, 1964.

Descriptors: \*Farm wastes, \*Hogs, \*Properties, \*Pump testing, Solid wastes, Performance, Pump-ing, Efficiencies, Biochemical oxygen demand, Waste identification.

Identifiers: \*Waste properties, \*Characteristics,

Hog wastes from a confinement hog production unit were analyzed for daily quantity and physical and chemical properties. The pumping charac-teristics of the untreated hog wastes were determined with a diaphragm pump and a 6-inch auger. The quantity and quality of the manure are affected primarily by the size of the hogs, the type and quantity of the feed intake, the quantity of the water intake and the air temperature. The daily quantity of manure removed varies with the time of year. The average total solids content of the manure was 18.5 percent and 15.6 percent during the hot and cold months of the year respectively. The total nitrogen of the manure was 7 percent of the total dry matter. Results of the auger pumping test showed that manure can be pumped with greater efficiency and less power consumption than water. With the diaphragm pump the maximum pumping capacity for water is obtained at a higher pump speed than for manure under similar conditions of operation. The results of the pumping tests were presented graphically. (Parker-Iowa State) W72-01557

A STUDY OF SOME DISEASE HAZARDS WHICH COULD BE ASSOCIATED WITH THE SYSTEM OF APPLYING CATTLE SLURRY

PASTURE, Agricultural Research Council, Compton (Ennd). Inst. for Research on Animal Diseases. gland). Inst. for Research of Julian.
J. Deans Rankin, and R. J. Taylor.
The Veterinary Record, Vol 85, November 22, 1969, p 578-581. 3 tab, 7 ref.

Descriptors: \*Farm wastes, \*Soil-borne diseases, \*Slurries, Dairy cows, Waste water disposal, Soil contamination, Water pollution sources, Public health, Pollutant identification. Identifiers: Bacterial survival.

Physical and bacteriological examinations of 16 samples of cattle 'slurry' have been carried out. On three occasions potentially pathogenic bacteria were isolated, namely, one strain of Salmonella dublin and two strains of haemolytic Escherichia coli. Five strains of potentially pathogenic bacteria survived for 11 to 12 weeks in slurry, although none of them appeared to multiply. The system of slurry disposal on pasture and its implications are discussed. (Hazen-Iowa State)

DETECTION OF RADIOTUNGSTEN IN RAIN-WATER.

Radiation Center of Osaka Prefecture, Osaka

T. Mamuro, T. Matsunami, and T. Ishiyama.

# Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

#### Group 5A—Identification of Pollutants

Health Phys. 20 (1): 86-89. Illus 1971. Identifiers: Detection, Radio, Rain, Tungsten. W72-01592

## 5B. Sources of Pollution

CARBONATE EQUILIBRIA IN LAKE ERIE,

State Univ. (Coll.), Fredonia, N.Y. Kenneth G. Wood.

International Association for Great Lakes Research, Proceedings 13th Conference on Great Lakes Research, Part 2, p 744-750, 1970. 3 fig, 2 tah 18 ref.

Descriptors: \*Lake Erie, \*Carbonates, \*Equilibrium, Inorganic compounds, Carbon dioxide, Alkalinity, Hydrogen ion concentration, Gases, Equations. Mathematical studies.

Identifiers: Sodium carbonate solutions, Van Slyke analysis, Revelle equation.

Determinations of pH, total alkalinity, and total carbon dioxide (modified Van Slyke method) permitted to establish a relationship between the three characteristics in dilute sodium carbonate solution and water from Lake Erie. The results indicated that the commonly used equation, ascribed to Revelle, does not fully express the carbonate equilibria as such as influenced by the iron-pair complexes. Lake Erie water is not similar to dilute solution of sodium carbonate and contains less carbon dioxide at pH 8.3 to 9.5 than is predicted by the equation. (See also W72-01094) (Wilde-W72-01111

POLLUTION POTENTIAL OF SOME NEW HAMPSHIRE LAKES,

Dartmouth Coll., N.H. Dept. of Earth Sciences. S. L. Dingman, and A. H. Johnson. Water Resources Research, Vol 7, No 5, p 1208-1215, October 1971. 6 fig, 1 tab, 5 ref.

Descriptors: \*Lakes, \*New Hampshire, \*Water balance, \*Path of pollutants, \*Water pollution effects, Aqueous solutions, Water chemistry, Water pollution control, Dissolved solids, Mathematical models, Biodegradation, Sorption. Identifiers: Water pollution potential.

A combination of simple water-balance and massbalance equations produces an expression for the concentration of a dissolved pollutant in a lake as a function of time. This model includes expressions characterizing the lake equilibrium concentration and the rate at which equilibrium will be approached. These two parameters characterize the pollution potential of a lake. Pollution potentials for 23 New Hampshire lakes were evaluated and found to be closely correlated with lake size and drainage area. (Knapp-USGS) W72-01131

SIMULTANEOUS SOLUTE AND WATER TRANSFER FOR AN UNSATURATED SOIL,

Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.

For primary bibliographic entry see Field 02G. W72-01132

PREOPERATIONAL RADIOLOGICAL VEILLANCE OF THE FLORIDA POWER COR-PORATION'S CRYSTAL RIVER POWER REAC-

Florida State Div. of Health, Orland. Radiological and Occupational Health Section. C. L. Nayfield, W. Johnson, and B. P. Prewitt

Radiological Health Data and Reports, Vol 12, No 9, p 441-449, September 1971. 2 fig, 15 tab, 5 ref.

Descriptors: \*Monitoring, \*Radioisotopes, \*Florida, \*Nuclear powerplants, Path of pollutants, Water pollution sources, Water pollution effects. Identifiers: Crystal River (Florida).

Preoperational radiological surveillance was conducted by the Florida Division of Health around the Crystal River nuclear power generating plant site of the Florida Power Corporation starting in May 1969. A summary of data and statistically significant differences between sampling locations is presented. There has been a reduction in the levels of artificial radionuclides present in the environment except for cesium-137. Levels of radionuclides in soil are not significantly different from control locations except for levels of potassimum-40 which appear to be lower than those of the um-40 which appear to be lower than those of the control locations. Levels of radionuclides in regetation are not significantly different from levels of comparable control locations. Despite dif-ferences in potassium-40 levels in soil, levels of potassium-40 in vegetation are not significantly dif-ferent between Crystal River and comparable con-trol locations. Gross beta radioactivity levels in sur-face water are highly dependent on the salinity of the water. (Knapp-USGS) W72-01154

DISPERSION IN NATURAL STREAMS.

Nebraska Soil and Water Conservation Commission, Lincoln. M. K. Bansal.

ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY 11, Paper 8540, p 1867-1886, November 1971. 8 fig, 1 tab, 29 ref, append.

Descriptors: \*Dispersion, \*Mixing, \*Path of pollutants, \*Tracers, \*Mathematical models, Turbulent flow, Diffusion, Adsorption, Turbulence, Virginia. Identifiers: Turbulent diffusion.

A one-dimensional mathematical model of dispersion accounts for the loss of dye due to decay and adsorption. This model predicts the time-concentration of the conservative pollutant in a stream where the lateral and vertical mixing of the pollutant are almost complete. A three-dimensional model of dispersion computes pollutant concentra-tion near the site of injection where the effects of lateral and vertical dispersion are important. Various empirical relationships determine the longitudinal, lateral, and vertical dispersion coefficients in natural streams. The dimensionless longitudinal and vertical dispersion parameters depend upon the Reynolds number only, while the lateral dispersion parameter depends on both the Reynolds number and the width-to-depth ratio of the stream. (Knapp-USGS) W72-01167

FACTORS CONTROLLING THE SUPPLY AND CHEMICAL COMPOSITION NEAR-SHORE AEROSOLS IN A NE COASTAL ENVIRONMENT,

Hebrew Univ., Jerusalem (Israel). Dept. of Geolo-

D. H. Yaalon, and J. Lomas Agr Meteorol. 7 (6): 443-454. Illus. 1970. Identifiers: Aerosols, Chemical, Coastal, Composition, Controlling, Environment, Minerals, Shore,

Na, Cl, SO4, and K were determined in nearground aerosols on a traverse normal to the coast up to a distance of 6 km from the shore at Caesarea, Israel. Statistically significant power or exponential functions can both express the rate of decrease in concentration with distance from the shore. The larger droplets which were deposited mainly up to 1500 m were essentially of sea water composition with regard to the major ions. The remaining smaller particles had a relatively larger excess of SO4. The stormier wind regime during the winter season produced a larger amount of sea spray which was not carried so far inland as the dry amount of sea spray which was not carried so far inland as the dry season spray. The behavior of SO4 differs from that of Cl and Na. Local topography has considerable influence on the distribution and deposition of the airborne salts. The frequency distribution of concentration at any one station tends to be lognormal.—Copyright 1971, Biological Abstracts, Inc.

W72-01194

MICROBIOLOGY OF FOODS: VI. SALMONEL-LAE IN MEAT AND LYMPH GLANDS OF SLAUGHTERED HORSES. BACTERIOLOGY WATER AND RESIDUAL FLUIDS (IN SPANISH),

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Buenos Aires Univ. (Argentina). Facultad de Agronomia y Veterinaria.

J. J. Monteverde, D. H. Simeone, N. Moran, C. A.

Hermida, and M. M. Colombino.

Rev Fac Agron Vet Univ Buenos Aires. 17 (2): 57-67 1969 English summary. Identifiers: Bacteriology, Fluids, Foods, Glands, Horses, Lymph, Meat, Microbiology, Residuai, Sal-monellae, Slaughtered, Waste.

Samples (400) were obtained from 5 different plants and from 100 horses. The samples were 10 g cutaneous, masseter and diaphragm muscle and mesenteric lymph node tissues. Salmonella was detected in 47% of the carcasses: 32% in the mesenteric lymph nodes and 21%, 15% and 7% respectively in, diaphragm, masseter and cutaneous muscle. A total of 19 types of Salmonella were identified. Water samples were also analyzed; from 44 samples 20 were contaminated and of 10 waste ramifications are discussed.—Copyright 1971, Biological Abstracts, Inc.

A COMPARISON OF THE ENTEROCOCCI INDEX WITH COLIFORM INDEX AS INDICA-TION OF FAECAL POLLUTION OF WATER, All-India Inst. of Hygiene and Public Health, Cal-

Ranjit Sen, and Surjya Narayan Ghosh. Indian J Med Res. 58 (9): 1164-1168 1970. dentifiers: Coliform, Enterococci, Fecal, Index,

The determination of the enterococci index by the multiple tube dilution method was assessed using 2 media, dextrose azide broth and ethyl violet dextrose azide broth, and compared with coliform index which uses lactose broth. Ethyl violet dextrose azide broth not only detected very small numbers of enterococci, but would also allow an accurate report of fecal pollution of water to be given after 48 hr more often than the use of the other 2 media. Substitution of the coliform index by enterococci is recommended as an index of water safety.--Copyright 1971, Biological Abstracts. Inc W72-01228

HYGIENIC ASPECTS OF THE ESTABLISH-MENT AND ORGANIZATION OF SANITARY--PROTECTIVE ZONES (IN RUSSIAN),

M. M. Kochanov, and S. D. Zaugol'Nikov. Gig Sanit. 35 (10): 62-65 1970. Identifiers: Air, Hygienic, Meteorological, Organization, Pollution, Protective, Sanitary, Vegetation, Zones.

Various considerations related to the use of sanitary-protective zones are examined. These include: characterization of the pollution source; characterization of the prevailing meteorological conditions; and the choice of vegetation grown in the sanitary-protective zone. Literature up to mid-1969 is reviewed .-- Copyright 1971, Biological Ab-W72-01230

COMPARATIVE SURVIVAL RATE OF SOME ENTEROVIRUSES IN WATER WITH DIF-FERENT DEGREES OF POLLUTION, (IN RUS-

Institut of General and Municipal Hygiene, Moscow (USSR).

G. A. Bagdasar'yan. Zh Mikrobiol Epidemiol Immunobiol. 47 (8): 96-98. Illus. 1970.

#### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

#### Sources of Pollution-Group 5B

Identifiers: Comparative, Degrees, Echovirus, Enteroviruses, Escherichia-Coli, Indicator, Myelitis, Phage, Polio, Pollution, Rate, River, Streptococ-cus-Faecalis, Survival, T-1, Tap, Virus.

The survival rate of enteroviruses (vaccine strains of poliomyelitis virus types LS, c 2ab and ECHO-7), Escherichia coli phage T1 and enterococcus (Streptococcus faecalis) was studied in tap water, river water and sewer water. Temperature, degree of water pollution and the type of strain had signifi-cant effects on the length of survival of the strains. The survival rate of the enteroviruses increased as the degree of pollution increased, and in the presence of bacterial and viral microflora. Phage TI survived the longest (more than 200 days) in water with various degrees of pollution.--Copyright 1971, Biological Abstracts, Inc. W72-01245

#### THE DISTRIBUTION OF THE PATHOGENS OF BOTULISM AND TETANUS IN THE AREA OF THE USSR.

A. T. Kravchenko, and L. M. Shishulina. Meditsina, Moscow, 1970. 200 p. Identifiers: Botulism, Clostridium-Botulinum, Clostridium-Tentani, Distribution, Fish, Fish-Meal, Pathogens, Soil, Tetanus, USSR.

Literature and other data on the distribution of Clostridium botulinum and C. tetani in the USSR are summarized. C. tetani is seeded in the soil and water and C. botulinum is found in fish in different areas of the country. Methods for sampling soil, water, fish and fish meal are described; the effects of a number of environmental factors and the condition of the fish on the occurrence of the pathogens are also shown.--Copyright 1971, Biological Abstracts, Inc. W72-01246

# DISTRIBUTION OF DDT AND TOXAPHENE IN HOUSTON BLACK CLAY ON THREE WATERSHEDS.

Texas A and M Univ., College Station. Dept. of Soil and Crop Science.

Allen R. Swoboda, Grant W. Thomas, Foster B. Cady, Ralph W. Baird, and Walter G. Knisel. Environ Sci Tech. 5 (2): 141-145 Illus. 1971. Identifiers: Black, Clay, DDT, Distribution, Houston, Insecticide, Leaching, Movement, Texas, Toxaphene, Watersheds.

The movement and distribution of DDT and Toxaphene in a heavy clay soil was studied on three Blackland Prairie watersheds in Texas. Less than 16% of the DDT (total of p, p-DDT, DDE, and DDD) and less than 22% of the Toxaphene applied over a 10-yr period was recovered in the top 5 ft of the soil. Between 60 and 75% of the recovered DDT was found in the top 12 in. of soil, but 90 to 95% of the Toxaphene was found in the upper 12 in. Movement of DDT into the lower soil depths was attributed to top soil being washed into the was attributed to top soil being washed into the large vertical cracks of the vertisol by rainfall. Leaching was also considered a factor in the downward movement of DDT, since a seep was found to contain from 0.2 to 1.2 ppb of DDT.--Copyright 1971, Biological Abstracts, Inc. W72-01262

# INCIDENCE IN RIVER WATER OF ESCHERICHIA COLI CONTAINING R FAC-TORS, Animal Health Trust, Stock (England). Farm

Livestock Research Center. Williams H.Smith.

Nature (London). 228 (5278): 1286-1288. 1970. Identifiers: Antibiotic, Escherichia-Coli, Human, Incidence, R, Resistance, River, Salmonella-Typhi,

Large numbers of E. coli with antibiotic resistance missible to pathogenic organisms, such as Salmonella typhi, were found in some British rivers. The principal source was insufficiently treated

human sewage.--Copyright 1971, Biological Ab-W72-01281

# THE SURVIVAL OF MYCOBACTERIA IN DIF-FERENT SUBSTRATES OF THE ENVIRON-MENT, (IN RUSSIAN), M. M. Ivanov, and Y. M. Skhiladze.

Tr Gos Nauch-Kontr Inst Vet Prep. 16: 142-144. 1969.

Identifiers: Avian, Bird, Environment, Manure, Medium, Milk, Mycobacteria, Petranyanas, Sub-strates, Survival.

Determinations were made of the survival rate of mycobacteria of the avian type in distilled and tap water, milk, and bird manure. Samples (100 ml) were stored at 4 and 20C for 16 mo and aliquots of these were taken at 4, 8, 12, and 16 mo. intervals and plated on Pentranyana's medium; pH was also determined. Mycobacteria die within 8 mo. in milk, viability in water is retained for more than 16 mo.— Copyright 1971, Biological Abstracts, Inc. W72-01284

# THE POSSIBLE TRANSPORT OF TRACE METALS VIA MOULTED COPEPOD EX-OSKELETONS, Stanford Univ., Pacific Grove, Calif. Hopkins

Marine Station.

Limnol Oceanogr. 15 (5): 756-761. 1970. Identifiers: Bio, Copepod, Cycles, Exo, Geochemical, Metals, Molted, Skeletons, Trace, Transport.

Concentrations of Ca, Cd, Co, Cu, Fe, Mg, Mn, Ni, Pb, Sr, and Zn in 10 surface-zoo-plankton samples were compared with the values determined for 12 samples collected at 100 or more meters. Average values for Cu, Fe, Mn, Ni, Pb, Sr, and Zn were higher in the deep samples. It was postulated that more of these elements had become adsorbed to copepod exoskeletons at greater depths because food-dependent molting rates were lower; thus more time was available for elemental adsorption to take place. If this hypothesis is correct, molted copepod exoskeletons may be important in biogeochemical cycles. Copepods are the most abundant multicellular animals in the world, and there are 11 cast exoskeletons for every adult; these slow-sinking exuvia may well be capable of taking up elements by adsorption-exchange long after leaving the living animals. Thus, a large total surface-area is provided on which important chemical reactions may take place.—Copyright 1971, Biological Abstracts, Inc. W72-01311

# TROPHIC STATE OF LAKES IN NORTH CEN-TRAL FLORIDA, Florida Univ., Gainesville. Water Resources

Research Center. For primary bibliographic entry see Field 05C. W72-01331

#### CROSS-SECTIONAL STUDY OF THE EFFECTS OF SMELTER WASTEWATER DISPOSAL ON WATER QUALITY OF THE COLUMBIA RIVER DOWNSTREAM FROM TRAIL, BRITISH

COLUMBIA,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Water Branch. tawa (Ontario S. W. Reeder.

Canada Department of Energy, Mines and Resources Inland Waters Branch Technical Bul-letin No 39, 1971. 16 p, 6 fig, 3 tab, 2 ref.

Descriptors: \*Water pollution sources, \*Water pollution effects, \*Water quality control, \*Columbia River, \*Industrial wastes, Chemical analysis, Water temperature, Data collections, Water quality, Hydrologic data, Streamflow, Flow rates. Identifiers: \*Smelter wastewater, Canadian Border.

A total of 59 water samples were collected from three sites on the Columbia River over a seven-day period to locate the most suitable site for a permanent water quality sampling station and to assess the effects of smelter wastewater on the quality of the river water downstream from Trail, British Columbia. The results from chemical examination of the river water showed: (1) Mixing of the wastewater with the river water was complete at Site 3, approximately ten miles downstream from the sposal source, but was incomplete at Sites 1 and 2, one-half and three miles downstream from the source. For this and other reasons, Site 3 was judged to be the most suitable location for a permanent water quality station; (2) The effluent caused a considerable increase in total hardness, noncarbonate hardness, and calcium, zinc, sulfate, fluoride and phosphate content of the river water; (3) The concentration of pollutants in the Canadian portion of this river is generally low due to its relatively high discharge. (Woodard-USGS) W72-01424

# USE OF ULTRAVIOLET IRRADIATION IN THE DETERMINATION OF NUTRIENTS IN WATER WITH SPECIAL REFERENCE TO NITROGEN. Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Water Branch.

For primary bibliographic entry see Field 05A. W72-01425

# POTENTIAL POLLUTION OF THE OGALLALA

BY RECHARGING PLAYA LAKE WATER, Texas Tech Univ., Lubbock. Water Resources

R. G. Rekers, E. W. Huddleston, and D. M. Wells. Texas Tech University, Water Resources Center, WRC-70-4, 25 p. August 1970. 2 tab, 2 fig.

Descriptors: \*Playas, \*Groundwater recharge, Agricultural watersheds, Water pollution sources, \*Water quality, Nitrates, Phosphates, Ammonia, Nitrites, Chlorides, Sodium, Potassium, Calcium, Sulfates, Alkalinity, Inorganic compounds, Perticides, Bacteria, Viruses, Texas, Aquifers.

Identifiers: \*Ogallala Formation, Texas High

Water collected in playa lakes on the Texas High Plains appears suitable for recharge into the Ogal-lala Formation since nitrates and phosphates in agricultural runoff were not found in hazardous concentrations. Samples from 24 lakes in Lubbock county and 15 lakes bounded by Plainview, Hereford and Amarillo, provided the data for interpretation. Nitrates, ranging from 0.5 to 14.0 mg/l, were lower than local ground-water samples; ammonia was generally less than 1 mg/l; nitrite ranges from 0.002 to 0.6 mg/l; phosphates were generally less than 1.0 mg/l. Concentrations of chloride, sodium, potassium, calcium, sulfate and alkalinity were lower than existing groundwater samples. Playa water was found to be of better quality than groundwater when tested for inorganic chemicals. Other studies indicate low pesticide concentra-tions. Geologic properties of the aquifer are such that bacterial or viral contamination by playa water recharge is unlikely. (Popkin-Arizona) W72-01462

#### VIRUSES IN WATER.

Poliomyelitis Research Foundation, Johannesburg (South Africa).

For primary bibliographic entry see Field 05F. W72-01470

# BIOLOGICAL ASPECTS OF WATER POLLU-

National Inst. of Water Research, Pretoria (South Africa). For primary bibliographic entry see Field 05C.

W72-01472

#### Field 05 — WATER QUALITY MANAGEMENT AND PROTECTION

### **Group 5B — Sources of Pollution**

USER'S GUIDE AND DOCUMENTATION FOR OUTFALL PLUME MODEL, Environmental Protection Agency, Corvallis, Oreg.

For primary bibliographic entry see Field 07C. W72-01491

THE EFFECTS OF PESTICIDES ON WATER RESOURCE DEVELOPMENTS.

For primary bibliographic entry see Field 05C. W72-01517

AGRICULTURAL ASPECTS OF THE EFFECTS OF PESTICIDES IN WATER RESOURCE DEVELOPMENTS,

Agricultural Research Service, Washington, D.C. For primary bibliographic entry see Field 05C. W72-01519

MERCURY AND OTHER HEAVY METALS IN

WATER SUPPLIES, Souther (Henry) Engineering Co., Hartford, Conn. I. L. Newell

Journal of the New England Water Works Association, Vol 85, No 3, p 289-295, September 1971. 4

Descriptors: \*Water pollution sources, \*Heavy metals, \*Pollutant identification, \*Chemical analysis, Water pollution effects, Analytical techniques, lorganic compounds, Surface waters, Ground-water, Environmental effects, Ecology, Water chemistry. Identifiers: \*Mercury.

More than sixty groundwater and surface-water samples were analyzed for concentrations of 14 heavy metals. Trace amounts of silver, barium, copper, mercury, lead, and zinc were found in 10 of the samples. Mercury was found in only one sama well water sample that contained 0.004 mg/liter. Mercury is found in the environment in both organic and inorganic molecules. The organic molecules have been found to be many times more toxic than the inorganic forms of mercury. In water, the mercury is, for the most part, found as the most harmful methyl mercury. Almost all of the mercury found in living tissue is of the methyl type. It is believed that the various forms of mercury which may be deposited in the bottoms of stream and reservoirs can be brought in solution by aero-bic micro-organisms. In the winter and early spring, methylation occurs more rapidly than in the summer and fall months. More acidic waters will contain more methyl mercury than those with higher pH. (Woodard-USGS)
W72-01521

MOVEMENT AND PERSISTENCE OF DIEL-DRIN AND LINDANE IN SOIL AS IN-FLUENCED BY PLACEMENT AND IRRIGA-

Agricultural Research Service, Riverside, Calif. Soil and Water Conservation Research Div.

M. M. Cliath, and W. F. Spencer. Soil Science Society of America Proceedings, Vol 35, No 5, p 791-795, September-October 1971. 6 fig, 2 tab, 16 ref.

Descriptors: \*Pesticide residues, \*Path of pollutants, \*Dieldrin, \*Soils, \*Soil moisture, Soil water movement, Volatility, Biodegradation, Chemical degradation, Irrigation effects, On-site tests.

Redistribution and recovery of dieldrin and lindane were measured in two calcareous, low organicmatter soils, with and without irrigation. Dieldrin was highly stable and persistent, although volatilization apparently was significant for loss of dieldrin when the surface soil was wet and dieldrin was placed in the surface layer of soil. Dieldrin did not move significantly with the water and moved very little by diffusion. No catalytic breakdown of dieldrin occurred in the hot, dry soil. The movement and the dissipation of lindane from both soils were markedly greater than for dieldrin. Lindane moved downward with water application, espe-cially in the sandy loam soil. Volatilization losses can be reduced or prevented by keeping the soil surface dry or by incorporating or injecting insecti-cides into the soil. (Knapp-USGS) W72-01534

GEOCHEMICAL RANGES OF TITANIUM MIGRATION IN GROUNDWATER (O GEOK-HIMICHESKIKH DIAPAZONAKH MIGRATSII TITANA V PODZEMNYKH VODAKH), All-Union Scientific Research Inst. of Hydrogeolo-

gy and Engineering Geology, Moscow (USSR). For primary bibliographic entry see Field 02K. W72-01547

PLANT NUTRIENTS AND WATER QUALITY, For primary bibliographic entry see Field 05G. W72-01558

NITRATE AND SALT IN SOILS AND GROUND WATERS FROM LAND DISPOSAL OF DAIRY MANURE,

D. C. Adriano, P. F. Pratt, and S. E. Bishop. Soil Science Society American Proceedings, Vol. 35, 1971. p. 759-762, 3 fig, 3 tab, 14 ref.

Descriptors: \*Farm wastes, \*Water pollution sources, Groundwater, Salinity, Leaching, Nitrogen, Ammonia, Irrigation, Pastures, Lagoon, Application rate.

Identifiers: \*Dairy wastes, Chino-Corona Basin, Feedlots, Well waters.

The NO3 - contents of soils and ground waters un-derneath lands used for disposal of manures from dairies in the Chino-Corona Basin were determined. Soil and water samples were taken from 15 holes drilled to the top of water table in sites representing corrals, irrigated croplands, and pastures used as disposal areas. Considerable amounts of NO3- and salt were found in soil profiles underneath the disposal areas, although the magnitude was not as high as in profiles under cor-rals. Average NO3- -N concentrations in waters sampled from water tables were 26, 57, 45, and 74 ppm for control (undisturbed), corral, cropland, and pasture sites, respectively, exceeding the PHS recommended limit of 10 ppm NO3- N for safe drinking water. Domestic well waters pumped from deeper aquifers averaged 6 ppm of NO--N. Con-tributions of NO3--N to ground waters, as indicated by deep soil samples, on a per unit area ba-sis, tended to be: corralSpastureScropland. Existing conditions in the study area need some modifications if acceptable quality of the ground waters is to be maintained. (Bundy-Iowa State) W72-01561

#### 5C. Effects of Pollution

CARBONATE EQUILIBRIA IN LAKE ERIE, For primary bibliographic entry see Field 05B. W72-01111

SOME FACTORS AFFECTING THE DISTRIBU-TION OF ORCHESTIA LEACH IN ESTUARIES, Fisheries Research Board of Canada, St. Andrews (New Brunswick).

J. Exp Mar Biol Ecol. 5 (3): 276-284. Illus. 1970. Identifiers: Chlorinities, Distribution, Estuaries, Lethal, Orchestia, Orchestia-Cavimana, Orchestia-Gammarella, Orchestia-Mediterranea.

Lethal chlorinities were determined for 3 spp. of Orchestia Leach. In dilute sea water 48-h median lethal values (LC50) for O. gammarella (Pallas) and O. mediterranea A. Costa were influenced by intermoult stage but little by temperature within the range 4-23C. By comparing the 48-h LC50 for each species with the limiting high-water isohaline in the Medway estuary, it is concluded that low chlorinity during dispersal was the primary limiting factor for O. gammarella, but not for the other spe-cies studied. Sublethal effects of low chlorinity of the substratum and algal food on fertility of O. mediterranea morph mediterranea were demonstrated which might explain its abbreviated upstrated which might explain its abbreviated up-stream estuarine penetration. Two hypotheses might explain the downstream abbreviated estuarine penetration of O. cavimana Heller: an ex-clusion effect by interspecific sterile mating with O. gammarella and sublethal effects of high interstitial chlorinity on fertility.--Copyright 1971, Biological Abstracts, Inc. W72-01197

A COMPARISON OF THE ENTEROCOCCI INDEX WITH COLIFORM INDEX AS INDICA-TION OF FAECAL POLLUTION OF WATER, All-India Inst. of Hygiene and Public Health, Cal-

For primary bibliographic entry see Field 05B. W72-01228

THE DISTRIBUTION OF THE PATHOGENS OF BOTULISM AND TETANUS IN THE AREA OF THE USSR.

For primary bibliographic entry see Field 05B. W72-01246

LABORATORY EXPERIMENTS ON EFFECTS OF INSECTIDES AGAINST BLACKFLY LAR-VAE (DIPTERA:SIMULIDAE) AND FISH, Kyoto Prefectural Univ. of Medicine (Japan).

Dept. of Zoology. Kikuo Matsuo, and Tatsuo Tamura.

Botyu-Kagaku Bull Inst Insect Contr. 35 (4): 125-130, 1970

Identifiers: Black, Diptera, Fish, Fly, Insecticides, Laboratory, Larvae, Plecoglossus-Altivelis, Sacco-Temmincki, Safety, Salmo-Irideus, Simuliidae, Simulium-Aokii, Simulium-Venustum.

The laboratory experiments were carried out to find which insecticides would be more effective on blackfly larvae control in a river and would have lower toxicity to the fishes. Fourteen insecticides were tested and the larvae used were Simulium aokii and S. venustum and the fishes used were Simulium and he fishes used were Plecoglossus altivelis, Salmo irideus and Sacco temmincki. Results indicate that the wettable powder of Baytex and Sumithion are more suitable for regular control of the blackfly larvae living in a river.—Copyright 1971, Biological Abstracts, Inc. W72-01252

THE FATE OF FISH INTRODUCED AS PREDA-TORS ON INSECTS IN MISSOURI OXIDATION

Federal Water Pollution Control Administration, Chicago, Ill. H. J. Fisher, L. W. Smith, Jr., and W. R. Enns.

Mosquito News. 30 (4): 523-527. 1970. Identifiers: Bantam, Black, Bluegill, Bullhead, Cold, Fate, Fish, Gambusia, Golden, Insects, Lagoons, Midge, Missouri, Mosquitofish, Oxidation, Predators, Redear, Shiner, Sunfish.

Five species of fish were stocked in several sewage oxidation lagoons in the vicinity of the Columbia, oxidation lagoons in the vicinity of the Columbia, Missouri. These included bantam sunfish, bluegill, redear sunfish, golden shiner and black bullhead. Observations also were made in other lagoons stocked with goldfish and mosquitofish by municipal health department and other personnel. Goldfish and golden shiners survived fairly well under conditions found in the oxidation lagoons. Mosquitofish (Gambusia) thrived under surveys Mosquitofish (Gambusia) thrived under summer conditions but could not tolerate seriously cold weather. Clear ice on lagoons did not appear to be detrimental but when covered by snow caused anaerobic conditions, with concomitant mortality of fish and tadpoles. Stocked fish made very little use of midge larvae as food. However, much further study is needed on fish stocking to deter-

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## WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

#### Effects of Pollution—Group 5C

mine their effectiveness in controlling insect populations in oxidation lagoons.—Copyright 1971, Biological Abstracts, Inc. W72-01254

VOLUME OF FISH FRY SUFFOCATIONS ON SHALLOW WATERS OF THE KREMENCHUG RESERVOIR UNDER THE CONDITIONS OF WATER 'BLOOM', (IN RUSSIAN), Akademiya Nauk URSR, Kiev. Instytut

Akademiya Hidrobiologii.

A. F. Lyashenko, and N. H. Yvanyukov.

Gidrobiol Zh. 6 (5): 57-65. Map. 1970. English

Identifiers: Bloom, Cyanophycease, Fish, Fry, Ide, Kremenchug, Perch, Reservoir, Ruffe, Shallow, Suffocations, USSR, Volume.

The effect of different concentrations of Cyanophyceae on fish fry number is considered as well as the conditions of appearance of local summer fry suffocations as a result of water bloom on shallow waters of the Kremenchug reservoir. The algae have no negative effect on fish fry numbers. The greatest amount of perch and pike-perch fry at shallow waters of the reservoir was observed with moderate development of the algae (concentration up to 200-250 g/cu m). Fish fry (fingerlings) died as a result of suffocation in the low part of the Kremenchug reservoir where 14 spp. were found among which Percoidea predominated (perch, pike-perch, ruffe) and ide from the Cyprinidae family.—Copyright 1971, Biological Abstracts, Inc. Abstracts, Inc. W72-01266

TROPHIC STRUCTURE. AVAILABLE RESOURCES AND POPULATION DENSITY IN TERRESTRIAL VS. AQUATIC ECOSYSTEMS. Georgia Univ., Athens. Dept. of Zoology.

R. G. Wiegert, and D. F. Owen. J Theor Biol. 30 (1): 69-81. Illus. 1971.

Identifiers: Aquatic, Competition, Density, Ecosystems, Population, Resources, Structure, Terrestrial, Trophic.

The relationship between available resources and the level at which density is regulated may not be obvious where direct inter- or intraspecific competition for available resources is terpretation of such cases requires that a distinction be made between organisms ingesting living material (biophages) and those subsisting on dead organic mater (saprophages). A modified trophic model incorporating this distinction is used to develop a hypothesis explaining how mean densities of 1st-order biophagus organisms are deter-mined in accordance with life history characteristics of autotrophs in the system. biophage densities will be held at low levels where effects of escape from control would be most damaging to a system, i.e. where the biotic potential of 1st-order biophages is much higher than that of the autotrophs. The hypothesis accounts for density levels and regulatory mechanisms differing with trophic levels and helps to explain the prevalence of well-developed 3-level trophic communities in terrestrial exosystems and 4-level communities in aquatic systems.--Copyright 1971, Biological Abstracts, Inc. W72-01268

UPPER LETHAL TEMPERATURE AND THER-MAL SHOCK TOLERANCES OF THE OPOS-SUM SHRIMP, NEOMYSIS AWATSCHENSIS, FROM THE SACRAMENTO-SAN JOAQUIN

ESTUARY, CALIFORNIA,
California State Dept. of Fish and Game, Sacra-

mento.

Calif Fish Game. 57 (1): 17-27. Illus. 1971.

Identifiers: California, Estuary, Lethal, Neomysis-Awatschensis, Opossum, Sacramento, San-Joaquin, Shock, Shrimp, Temperature, Thermal,

Temperature tolerances tests were performed on adult opossum shrimp, N. awatschensis, collected in the Sacramento-San Joaquin estuary from July 1968 to Oct. 1969. The upper lethal temperature for adult N. awatschensis was between 75.6 and 77.8 F as determined from 48-hr thermal bioassays. The tolerance of adult N. awatschensis to rapid increases in temperature decreased when the acclimation temperature increased. Rapid temperature rises of 25 F or less caused little or no mortalit provided the test temperature did not reach 87 F. urvival was inversely related to temperature above 87 F. Rises of more than 25 F caused significant mortalities even though the maximum tem-perature did not reach 87 F. Survival decreased rapidly with increased exposure time at lethal tem-peratures.—Copyright 1971, Biological Abstracts, W72-01279

TOXICITY OF PESTICIDES TO THE CRUSTACEAN GAMMA-RUS LACUSTRIS, Bureau of Sport Fisheries and Wildlife, Columbia,

Mo. Fish Pesticide Research Lab.

Herman O. Sanders.
US Bur Sport Fish Wildl Tech Pap. 25. 3-18. 1969.
Identifiers: Aldrin, Coumaphos, Crustacean, DDT,
Defoliant, Exposure, Fungicides, GammarusLacustris, Herbicides, Insecticides, Pesticides, Temperature, Time, Toxicity.

Static bioassays were conducted to determine the relative acute toxicities of some insecticides, herbicides, fungicides, and a defoliant to the scud G. lacustris. Toxic effects were measured by deter-mination of Median Lethal Concentration (LC50) for 24-, 48-, and 96-hr exposures at 70 F. Organophosphate insecticides were generally more toxic than chlorinated hydrocarbon insecticides. There was a wide range in the toxicities of insecticides to scuds, with 24-hr LC50 values ranging from 0.32 microgram/l for coumaphos, an organophosphate insecticide, to 56,000 microgram/I for aldrin, a chlorinated hydrocarbon insecticide. Herbicides and fungicides were less toxic than most insecticides. DDT was 2.6 times as toxic to scuds at 70 F as at 40 F after a 24-hr exposure, 4.5 times as toxic at 70 F after a 48-hr exposure, and 7.0 times as toxic at the higher temperature after a 96-hr exposure. DDT was 5.7 times as toxic to 1-mo.-old animals as to 3-mo.-old animals after a 24-hr exposure.--Copyright 1971, Biological Abstracts, Inc W72-01280

A REVIEW OF POSSIBLE CAUSES OF MOR-TALITY OF OYSTER LARVAE OF THE GENUS CRASSOSTREA IN TOMALES BAY, CALIFOR-

University of the Pacific, Dillion Beach, Calif. Pacific Marine Station.

Carl J. Berg, Jr. Calif Fish Game. 57 (1): 69-75. Illus. 1971. Identifiers: Bay, Blooms, California, Crassostrea, Dinoflagellate, Genus, Larvae, Mortality, Oyster, Review, Tomales.

Oysters of the genus Crassostrea do not produce successive generations in Tomales Bay, California, because of the failure of the larvae to survive and set. Excessive turbidities, lack of proper food, and blooms of dinoflagellates are probably the major causes of oyster larvae mortality, although there are other contributing factors.—Copyright 1971, Biological Abstracts, Inc. W72-01289

EFFECTS OF PHYSICAL AND CHEMICAL CONDITIONS ON THE DETOXIFICATION OF

WARF Inst., Inc., Madison, Wis.

Terrence H. Lee, Philip H. Derse, and Stephen D.

Trans Amer Fish Soc. 100 (1): 13-17. Illus. 1971. Identifiers: Antimycin, Aquatic, Chemical, De, Goldfish, Management, Mortality, Physical, ToxifiLaboratory studies using both fish (goldfish) and yeast assays were made to determine the effects of various physical and chemical conditions on the toxicity and stability of antimycin. Chemical studies determined that pH is the most important factor. Half-lives of antimycin for pH's of 4.5 to 11.0 varied from over 7 hr to 6 min. Alkalinity and hard-ness were of no simificance. Screenies were 1 laboratory. ness were of no significance. Sorption on Lake Mendota, Wisconsin sediments was negligible up to suspended solids concentrations of 1.5%. The halflife in sunlight of antimycin in distilled water was in 10 min; at 200 ft candles about the same as in darkness. Mortality time for fish increased by approximately a factor of 3 for 4C compared to 24C. Use of ethanol as an anti-freeze for winter use was satisfactory .-- Copyright 1971, Biological Ab-W72-01292

THE DELAWARE OYSTER INDUSTRY: A REALITY, Delaware Univ., Lewes. Marine Lab.

For primary bibliographic entry see Field 05G. W72-01294

OCCURRENCE OF TOXIC BIVALVE MOL-LUSCS DURING A GYMNODINIUM BREVE RED TIDE.

Gull Coast Water Hygiene Lab., Dauphin Island,

Joseph M. Cummins, Abner C. Jones, and Alan A. Stevens

Trans Amer Fish Soc. 100 (1): 112-116. Map.

Identifiers: Bivalve, Clam, Coquinas, Crassostrea-Campechiensis, Donax-Variabilis, Fish, Gymnodinium-Breve, Macrocallista-Nimbosa, Mercenaria-Campechiensis, Molluses, Mortality, Oyster, Red, Tide, Toxic.

Extensive fish mortality has been associated with G. breve 'red tides' along the west coast of Florida. Toxicological evidence was strongly incriminated G. breve as being the primary source of 2 toxic components detected in oysters and clams exposed to increased numbers of G. breve. From Aug. to Nov. 1967, G. breve 'red tide' conditions were ported from the mouth of Tampa Bay to Redfish Pass, south of Charlette Health ass, south of Charlotte Harbor on the west coast of Florida. The present study examines the relationship of increased numbers of G. breve to the occurrence and distribution of toxic oysters and clams. The most severe G. breve 'red tide' conditions occurred during the 1st day of sampling. G. breve cell counts averaged 1500-2400 organisms/ml in the offshore waters, 300 organisms/ml in the surf zone, and 820 organisms/ml in Venice Inlet. Water collected offshore and from the head of the Inlet contained an ether-soluble substance that was toxic to mice. At this time a large number of dead fishes were observed lining the beaches and floating offshore. Hard clams (Mercenaria campechiensis) and sunray clams Macrocallista nimbosa) collected from the head of Venice Inlet contained 270 and 140 mouse units of toxin per 100 g of meats, respectively. Oysters (Crassostrea virginica) collected south of Bird Island the same day contained 75 mouse units of toxin per 100 g of meats. On the third day of sampling, coquinas (Donax variabilis) collected from the surf zone south of Midnight Pass were highly toxic, containing 550 mouse units per 100 g of meats. The toxicity of the coquinas was the highest ever detected by this laboratory in bivalve molluscs exposed to G. breve 'red tide' conditions. Seawater, oyster, and coquina samples collected from the Venice area in the absence of G. breve 'red tide' conditions did not contain detectable amounts of toxin.--Copyright 1971, Biological Abstracts, Inc.

NOTES ON AN OXYGEN-DEPLETED SUBSUR-FACE CURRENT OFF THE WEST COAST OF

A. H. B.De Decker.

S Afr Div Sea Fish Invest Rep. 84. 1-24. Illus. 1970.

# Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

#### Group 5C-Effects of Pollution

Identifiers: Africa, Coast, Current, Depleted, Maasbanker, Mackerel, Off, Oxygen, Phyto, Pilchard, Plankton, Sardinops-Ocellata, Scomber-Japonicus, South, Subsurface, Trachurus-Trachu-

An O2-poor subsurface current circulating within 20 mi. off the west coast of South Africa is described, including its seasonal and long-term fluctuations over a period of 10 yr. The apparent correlation between the long-term fluctuations of this current and those of the abundance of phytoplankton, zooplankton, pilchard eggs and commercial catches of pilchard Sardinops ocellata, maasbanker Trachurus and mackerel Scomber japonicus is examined. The possibility of mass mortalities being caused by sudden transgressions of this current is discussed. The origin of the current is traced back to the subsurface O2 minimum in the South Eastern Tropical Atlantic. The current is identified as an offshoot of the Deep Compensation Current postulated by Hart and Currie (1960) .--Copyright 1971, Biological Abstracts, Inc. W72-01296

#### EFFECT OF ACIDS AND ALKALIES ON SUR-VIVAL OF BLUEGILLS AND LARGEMOUTH BASS.

Bureau of Commercial Fisheries, Milford, Conn. Biological Lab.

Anthony Calabrese.

U S Bur Sport Fish Wildl Tech Pap. 42. 3-10. 1969. Identifiers: Acids, Alkalies, Aquarium, Bass, Bluegills, Largemouth, Lepomis-Macrochirus, Manipulation, Micropterus-Salmoides, pH, Sur-

To determine whether manipulation of H-ion concentration of the water could be used to selectively kill bluegills (Lepomis macrochirus) in farm-pond fish populations consisting of bluegills and largemouth bass (Micropterus salmoides), tests were conducted with both tap and pond waters in aquariums and with stream water in plastic-lined pools. The pH was changed by addition of hydrochloric acid, acetic acid, sodium hydroxide, and calcium hydroxide; tests were carried out in the pH range from 3.3 to 11.2. Large bass, 17.8 to 27.9 cm long,appeared to be less susceptible to rapid changes in pH than bluegills or small bass (1.3 to 10.2 cm), but small bass were slightly more susceptible than bluegills (2.5 to 22.7 cm). From the variability of results in different tests and the slight differences in pH tolerance between bluegills and bass, it is concluded that pH manipulation is impractical as a method for selectively thinnning Copyright 1971, Biological Abstracts, Inc.
W72-01298

# SOME EFFECTS OF SILT TURBIDITY ON BEHAVIOR OF JUVENILE LARGEMOUTH BASS AND GREEN SUNFISH,

Univ. S. Dak., Vermillion.

Norman W. Heimstra, David K. Damkot, and Norman G. Benson.

U. S. Bur Sport Fish Wildl Tech Pap. 20. 3-9. Illus.

1969

Identifiers: Aquarium, Bass, Behavior, Green, Juvenile, Largemouth, Lepomis-Cyanellus, Micropterus-Salmoides, Silt, Sunfish, Turbidity.

Behavior of juvenile largemouth bass (Micropterus salmoides) and green sunfish (Lepomis cyanellus) in aquariums was measured under conditions of clear water, 4-6 JTU (Jackson Turbidity Units), and 14-16 JTU for 30 days. The activity of bass was significantly reduced by turbidity; sunfish activity was reduced, but not significantly. Feeding and attach behavior was not influenced. Scraping conditions. There was evidence that turbidity disturbed normal social hierarchies in green sunfish.--Copyright 1971, Biological Abstracts, Inc. W72-01300 behavior of both species was higher under turbid

# ASSIMILATION OF DETRITUS AND ITS AS-SOCIATED BACTERIA BY THREE SPECIES OF ESTUARINE ANIMALS, Zool. Dep., N.C. State Univ., Raleigh, N.C. North

Carolina State Univ., Raleigh. Dept. of Zoology. Sidney Marshall Adams, and J. W. Angelovic. apeake Sci. 11 (4): 249-254. Illus. 1970. Identifiers: Animals, Assimilation, Bacteria, Bitti-um-Varium, Detritus, Eel, Estuarine, Glycera-Dibranchiata, Grass-M, Palemonetes-Pugio, Spe-

The assimilation of detritus and its associated bacteria by 3 spp. of macrofauna which are abundant in eel grass beds during the summer was inin eel grass beds during the summer was investigated in a laboratory study. The amount of 14CO2 respired per milligram of dry body weight by animals that fed on different types of labeled food was compared to determine the relative amount of assimilation of a particular food. Animals were fed sterilized and unsterilized detritus labeled with 14C to determine if they assimilated in the relative to determine if they assimilated wither the detribute are as its respectively. similated either the detritus per se or its associated bacteria as food. All 3 spp. ingested and assimilated detritus. After 3 days of feeding, a small gastropod, Bittium varium, had ingested and assimilated more detritus per mg of body weight than either the grass shrimp, Palaemonetes pugio, or the polychaete, Glycera dibranchiata. Both Palaemonetes and Bittium assimilated 14C from labeled bacteria as-sociated with the detritus as well as from the labeled detritus. All 3 spp. assimilated some 14C from soluble sources.—Copyright 1971, Biological Abstracts, Inc. W72-01316

# ACETYLENE REDGE 1.3. TION) IN WISCONSIN LAKES, Madison. Water Resources

Center.
D. Rusness, and R. H. Burris.

Reprint OWRR B-020-WIS, from Limnology and Oceanography, Vol 15, No 5, p 808-813, September 1970. 3 fig, 2 tab, 9 ref. OWRR B-020-WIS

Descriptors: \*Analytical techniques, \*Nitrogen fixation, \*Phytoplankton, \*Oligotrophy, \*Eutrophication, Cyanophyta, Seasonal, Aquatic populations, Wisconsin, Lakes.

Nitrogen fixing algae, Depth, Lake Mendota, Trout Lake, Crystal Lake, Little Arbor Vitae Lake.

Acetylene reduction has been used as an index of the nitrogen-fixing capacity of the phytoplankton of representative oligotrophic and eutrophic lakes in Wisconsin. Acetylene reduction was not mea-surable in samples from oligotrophic Crystal Lake but was vigorous in samples from eutrophicated lakes. The activity during the season fluctuated widely with the development of blooms of nitrogenfixing blue-green algae; no activity was demonstrated during winter months. Acetylene reduction was low in early morning, rose to a peak at noon, and then declined. Activity and population generally decreased with depth. On the other hand, too intense light inhibits certain algae. The algae from 0.9 m reduced acetylene more rapidly at this depth than at the surface; the samples taken from 2.7 m also reduced more acetylene when incubated W72-01324

# THE LITTORAL MACROPHYTE VEGETA-TION OF LAKE WINGRA,

Wisconsin Univ., Madison. Water Resources For primary bibliographic entry see Field 02H.

W72-01325

# EFFECTS OF PESTICIDE USAGE ON WATER

QUALITY, Wisconsin Univ., Madison. Water Resources

G. Chesters, and J. G. Konrad.

Reprint OWRR B-016-WIS, from BioScience, Vol 21, No 12, p 565-569, June 15, 1971. 66 ref. OWRR B-016-WIS (14).

Descriptors: \*Pesticide residues, \*Herbicides, \*Ru-noff, \*Soil erosion, \*Sediments, \*Surface waters, \*Pesticide removal, Aquatic weeds, Adsorption, Freshwater fish, Birds.

Identifiers: \*Organochlorine insecticides, \*Aquatic enviornment, \*Water pollution by pesticide, Organophosphorus insecticides, Aquatic organisms, PCB, Volatilization, Plant uptake, Pesticide moni-toring, Aerial transport, Biological magnification, Natural renovation, Great Lakes.

The authors review and discuss the extent of water pollution by pesticides as evidenced by their effects on fish and wildlife. The importance of biological magnification--a process by which pesticide residues are concentrated by aquatic organisms at each stage of the food chain-is emphasized. Included in the review are important pathways of pesticide transport to the aquatic environment, major mechanisms and processes of pesticide dis-sipation from the environment, and possible methods of pesticide removal from water bodies. The necessity of the natural renovation process, like use of more rapidly degradable pesticides, is considered since removal of pesticides from large bodies of water is presently not feasible. Evaluation of toxicological properties and persistence of degradation products of new pesticides in the environment is needed. W72-01326

# PHYTOPLANKTON SPECIES AND POPULA-TIONS IN THE PAMLICO RIVER ESTUARY OF NORTH CAROLINA, North Carolina State Univ., Raleigh. Dept. of

Available from the National Technical Information Available from the National Technical Information Service as PB-204 489, \$3.00 in paper copy, \$0.95 in microfiche. North Carolina Water Resources Research Institute, Raleigh. Report No 56, September 1971. 147 p, 37 fig, 2 tab, 27 ref, 2 Append. OWRR B-004-NC (11).

Descriptors: \*Estuaries, \*Eutrophication, \*Algal blooms, \*Phytoplankton, \*Nutrients, Water pollution effects, Aquatic algae, North Carolina, \*Algae, Diatoms, \*Dinoflagellates, \*Red tide, Water pollution sources.
Identifiers: \*Pamlico River estuary.

The Pamlico River Estuary extends some 35 miles from Washington, N. C. to Pamlico Sound. The phytoplankton cycle of this estuary is completely dominated by dinoflagellates. Diatoms, however, become more and more important in the lower reaches of the river close to the point where it emp-ties into Pamlico Sound. The dominant organism is Peridinium triquetrum, that creates a red tide during January, February, and March. The peridinium is accompanied by other dinoglagellates. This bloom lasts until late March and then populations remain low until a late summer peak of algae dominated by G. aureolum, G. estuariale, K. rotundatum, Polykrikos sp., and Calycomonas ovalis. This increase takes place in late August and early September and is followed by a fall low that lasts until the early spring bloom begins in December or early January. This yearly cycle is similar to that found in several of the river estuaries that enter Chesapeak Bay. Even the red tide forming organism, P. triquetrum, is the same. Peridinium triquetrum is an indicator of extremely rich or polluted conditions. In the Pamlico River Estuary, the entichment comes from sewage from several small cities and from farm and swamp runoff. It is likely that the red tide is the result of large amounts of nitrate that reach the middle parts of the estuary in mid-winter. Phosphorus is in ample supply the year

TROPH TRAL F Research P. L. Bre Available Service a in micro 102 p, 1 004-FLA

Descripto Phosphor Model str Identifier Multiva

General i lakes and establishe period. F sandy ter and high property. traoligotr Ridge re drainage Oklawaha by multiv groups de index of trophic in establish trophic c Nitrogen for the lak were estir conditions W71-0600 W72-0133

AQUATIO YGEN U' Water Po gland). William J. Journal W 43, No 7, p

Descriptor \*Aquatic solved ox plants, La Detritus, H Identifiers:

Aquatic we ness under by passage refractory position ov nitable sus bilization. molecule averaged a sues varied N regenera content of day. Quanti dicted with tion and the Wisconsin) W72-01356

> BLUE-GRE HYDROBIO SINIC-AK' Polish Aca Ecology; as saw. Dept. o Irena Spodn Wiadomosc 163, 1971.

# WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

# Effects of Pollution-Group 5C

TROPHIC STATE OF LAKES IN NORTH CEN-TRAL FLORIDA,
Florida Univ., Gainesville. Water Resources

Research Center.

P. L. Brezonik, and E. E. Shannon.

Available from the National Technical Information Service as PB-204 491, \$3.00 in paper copy, \$0.95 in microfiche. Publication No 13, August 3, 1971. 102 p, 14 fig, 27 tab, 76 ref, append. OWRR B-004-FLA (6).

Descriptors: \*Florida, \*Eutrophication, Nitrogen, Phosphorus, Water quality, \*Lakes, Nutrients, Model studies.

Identifiers: \*Trophic state index, Cluster analysis, \*Multivariate analysis.

General limnological and trophic conditions of 55 lakes and ponds in north and central Florida were established over an extensive one year sampling period. Florida lakes are typically shallow and in a sandy terrain. Most of the lakes have soft water. and high organic color is a common but variable and mgn organic color is a common out variable property. Trophic conditions range from ultraoligotrophy in the sand-hill lakes of the Trial Ridge region to hypereutrophy in some large drainage lakes in Alachua County and in the Oklawaha River Basin. Trophic data were analyzed by multivariate techniques, and logical trophic groups derived by cluster analysis. A quantitative index of trophic state (TSI) was derived using 7 trophic indicators, and the TSI values were used establish quantitative relationships between lake trophic conditions and watershed characteristics. Nitrogen and phosphorus budgets were calculated for the lakes based on land use and population pat-terns in the watersheds, and critical loading rates were estimated from the budgets and the trophic conditions. (See also W71-01378; W71-03048: W71-06009) (Morgan-Florida) W72-01331

AQUATIC WEED DECAY: DISSOLVED OXYGEN UTILIZATION AND NITROGEN AND PHOSPHORUS REGENERATION, Water Pollution Research Lab., Stevenage (En-

gland). William J. Jewell.

Journal Water Pollution Control Federation, Vol 43, No 7, p 1457-1467, 1971. 3 fig, 4 tab, 17 ref.

Descriptors: \*Decomposing organic matter, 
\*Aquatic weeds, \*Water pollution sources, Dissolved oxygen, Nitrogen, Phosphorus, Aquatic 
plants, Laboratory tests, Mathematical models, 
Detritus, Herbicides, Organic matter. Identifiers: \*Nutrient regeneration.

Aquatic weeds were allowed to decompose in darkness under aerobic conditions with pH controlled by passage of air enriched in carbon dioxide. The refractory fraction of weeds that resisted decomposition over 3 to 6 months averaged 24% of the ignitable suspended solids (ISS). During aerobic sta-bilization, the tissues contained 1.0 mg of oxygen molecule per mg ISS. The initial decay rate averaged about half that of domestic wastewater. Regeneration of N and P of the biodegradable tissues varied from 0 to 100%. The maximum rate of N regeneration averaged 4.9% per day of the initial content of the element; that of P averaged 5.8% per day. Quantities of regenerated nutrients can be pre-dicted within 25% on the basis of refractory fraction and the initial nutrient concentration. (Wilde-Wisconsin) W72-01356

BLUE-GREEN ALGAE BLOOMS--A CURRENT HYDROBIOLOGICAL PROBLEM (ZAKWITY SINIC--AKTUALNY PROBLEM

HYDROBIOLOGII), Polish Academy of Sciences, Warsaw. Inst. of Ecology; and Polish Academy of Sciences, Warsaw. Dept. of Hydrobiology. Irena Spodniewska.

Wiadomosci Ekologiczne, Vol 17, No 2, p 157-163, 1971. 3 ref. English summary.

Descriptors: \*Cyanophyta, \*Nuisance algae, \*Eutrophication, Reviews. Identifiers: USSR.

Blue-green algae appears most frequently in stag-nant waters and waters with a sluggish current, rich in organic substances. Their persistent blooms, in organic substances. Their persistent blooms, which accompany progressive eutrophication, are widespread phenomenon. Three Russian language volumes--'Ecology and Physiology of Blue-green Algae' edited by L P Braginskii, Moscow and Leningrad 1965, 272 pages, 'Water Blooms' Part I, edited by A V Topachevskii, Kiev, 1968, 386 pages and Part II, 1969, 267 pages, describing research conducted on blue-green algae during the last ten years in the Soviet Union and which contain a discussion of world literature are reviewed. Emphysiology. discussion of world literature are reviewed. Emphasis was on the specific properties of blue-green algae which enable them to occur under conditions unfavorable to development of other plant organisms. (Auen-Wisconsin)

SOME ASPECTS OF THE BIOLOGY OF LAKE TRAWSFYNYDD: A POWER STATION COOLING POND,

Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs. John W. Whitehou

Hydrobiologia, Vol 38, No 2, p 253-288, 1971. 17 fig, 13 tab, 32 ref.

Descriptors: \*Cooling water, \*Balance of nature, \*Nuclear powerplants, \*Temperature, Biological communities, Water level fluctuations, Mineralogy, Communities, water level metadatasis, inflientage, Corplankton, Phytoplankton, Zooplankton, Heated water, Water circulation, Daphnia, Thermal stratification, Crustaceans, Rotifers.

Identifiers: \*Cooling pond, \*Lake Trawsfynydd

(Wales), Bosmina obtusirostris.

Lake Trawsfynydd (North Wales) supplies water for a direct cooled nuclear power station and also acts as the cooling pond; the water is recirculated in an essentially closed system. Structural modifica-tions in the original impoundment ensure maximum time for cooling the warmed discharge. Water volume equivalent to the mean volume the lake is passed through the power station in seven days. The lake and its macrophytes, phytoplankton, fauna, and zooplankton were studied. Cycles of abundance and numbers of Bosmina obtusirostris and Daphnia longispina were similar in both the warm and cold parts of the lake. Numbers of Diaphanosoma brachyurum and Ceriodaphnia quadrangula were larger in the cool main lake than in the warm lagoons, but the timing of the period of maximum population density was the same in both parts. There were two main generations per year in the life cycle of Cyclops abyssorum in the warm and cold sides of the lake.

AN ECOLOGICAL STUDY OF THREE FRESH-WATER PONDS OF HYDERABAD-INDIA. I. THE ENVIRONMENT,

timing of periods of increase and decrease in the

zooplankton have been recorded directly attributa-

ble to the warmed water discharged from the power

Osmania Univ., Hyderabad (India). Dept. of Botany; and Osmania Univ., Hyderabad (India). Hydrobiology Lab.

station. (Jones-Wisconsin)

Hydrobiologia, Vol 38, No 2, p 213-223, 1971. 2 fig, 3 tab, 30 ref.

Descriptors: \*Ecology, \*Ponds, \*Chemical analysis, Temperature, Seasonal, Ions, Algae, Salinity, Phytoplankton, Thermal properties, Hydrogen ion concentration, Dissolved oxygen, Carbon dioxide,

Ammonia, Organic matter. Identifiers: \*Hyderabad (India), Eichhornia cras sipes, Typha angustata, Ipomoea aquatica, Total solids. The diversity and complexity of the ecological phenomena of Indian fresh waters call for more data, particularly on ionic composition and the behavior of basic elements. Three ponds subject to diverse pollution near Hyderabad were studied. Chemical analyses were made of water from each pond for two years. Data were collected on water temperature in relation to the air temperature in relation to the air temperature in manner, rainy season, and in winter. The temperasummer, rainy season, and in winter. The temperature differences were, to a degree, attributed to water quantity but the intermediate sized pond did water quantity but the intermediate sized pond did not bear out this conclusion; the high salt content and dense algal population of that pond was possibly responsible for keeping it cooler. The ionic composition of these ponds was determined; their proportions differed considerably from Rodhe's (1949) standard composition. The ionic composi-tion of the same body of water also differed from season to season. The seasonal fluctuations, which have secondary importance in lakes, become more have secondary importance in lakes, become more significant in small freshwater bodies. It is stressed that the ionic composition assessed from a limited number of observations may lead to wrong conclu-sions. (Jones-Wisconsin) W72-01369

THE EXCRETION OF AMMONIA AND UREA BY MYA ARENARIA L (MOLLUSCA: BIVAL-

Newcastle upon Tyne Univ. (England).
J. A. Allen, and M. R. Garrett.
Comparative Biochemistry and Physiology, Vol. 39A, p 633-642, 1971. 4 fig., 1 ab, 20 ref.

Descriptors: \*Ammonia, \*Ureas, \*Mollusks, Salinity, Sea water, Amino acids, Metabolism, Mortality, Temperature, Laboratory tests. Identifiers: \*Excretion rates, \*Mya arenaria,

Mya arenaria was studied to determine excretion of ammonia and urea. After at least 10 days' starvation, they were housed in tanks with sea water, diluted with distilled water for reduced salinity experiments. Animals used measured between 5.5 cm and 6.3 cm total shell length. Excretion of ammonia and urea averaged 3.22 mg ammonia nitrogen per day and 0.21 mg urea nitrogen per day respectively at a salinity of 34 parts per thousand. There is a rapid increase in ammonia excretion rate when Mya is placed in water of lowered salinity and the change in rate is directly related to the salinity decrease. After 4 and 6 days in lowered salinity the excretion rate returned to the level recorded at full salinity. Although there is reason to believe that the results are somewhat less reliable than those for ammonia, it appears that urea is not excreted at an enhanced rate at a salinity of 17 parts per thousand when compared with that recorded at a salinity of 34 parts per thousand. (Jones-Wisconsin) W72-01364

STUDIES ON THE PRODUCTIVITY OF SEVERAL MASURIAN LAKES AND ON THE EFFECT OF FISH ON LAKE BIOCENOSIS (Z BADAN NAD PRODUKTYWNOSCIA KILKU JEZIOR MAZURSKICH ORAZ WPLYWEM RYB NA BIOCENOZE JEZIORA), Polish Academy of Sciences, Warsaw. Dept. of

Hydrobiology; and Warsaw Univ. (Poland). Dept.

of Hydrobiology. Anna Hillbricht-Ilkowska, Ewa Pieczynska, and Eligiusz Pieczynski.

Wiadomosci Ekologiczne, Vol 17, No 2 p 127-146, 1971. 1 fig, 1 tab, 57 ref. English summary.

Descriptors: \*Productivity, \*Trophic levels, \*Fish, Lakes, Biomass, Primary productivity, Phytoplankton, Zooplankton, Sedimentation, Benthos, Fish food organisms, Fish diets, Degradation (Decomposition), Fish stocking. Identifiers: \*Mazurian Lakes (Poland).

Results of several years investigations pertinent to the productivity of Mazurian lakes of different trophic levels and the effect of fish stocking on different aspects of lake ecosystems are summarized.

#### Field 05 - WATER QUALITY MANAGEMENT AND PROTECTION

# Group 5C - Effects of Pollution

The study of primary productivity included determinations of allochthonous matter, biomass of macrophytes, phytoplankton, and zooplankton, mechanism and regulation of the abundance, destruction processes, sedimentation, and trophic relations in benthos. Particular attention was given to accessibility of food sources in the eulittoral zone to the introduced fish. (Wilde-Wisconsin)

ON THE LIFE HISTORIES OF SOME BROWN ALGAE FROM EASTERN CANADA, National Research Council of Canada, Halifax (Nova Scotia). Atlantic Regional Lab. T. Edelstein, L C-M Chen, and J. McLachlan. Canadian Journal of Botany, Vol 49, No 7, p 1247-1251, 1971. 16 fig, 22 ref.

Descriptors: \*Life history studies, \*Phaeophyta, Epiphytology, Algae, Habitats, Cultures. Identifiers: \*Eastern Canada, Nova Scotia, Isthmoplea sphaerophora, Melanosiphon in-testinalis, Hecatonema maculans, Elachista lubrica,

The complete life cycles of five Phaeophycean species, three from the Ectocarpales and two from the Dictyosiphonales, from Nova Scotia, Canada, were completed in culture. Isthmoplea sphaerophora, Melanosiphon intestinalis, Hecatonema maculans, Elachista lubrica, and Ralfsia verrucosa replicated directly the parent plants. Detailed descriptions of the algae are given, but cytological studies were not made. Apart from Hecatonema maculans, where plurilocular sporangia only served as the inoculum, cultures were established from single unilocular sporangia. Cultures of Melanosiphon were derived from both uni- and plurilocular sporangia. No fusion was noted and the life cycle obtained in culture was probably asexual. The possibility is recognized that under conditions of culture a species may undergo an abbreviated cycle by asexual reproduction only. The original habitats are recorded. Three of the species are recorded as epiphytic on other algae. In culturing, the most satisfactory conditions of incubation were 13C with a photoperiod of 10 hrs light and an intensity of about 4000 lux. The culture medium was SWM-3 of Chen et al (1969), changed weekly. (Jones-Wisconsin) W72-01370

# COMPARATIVE STUDIES ON METABOLIC ACTIVITY OF PLANKTONIC, BENTHIC AND EPIPHYTIC BACTERIA,

Nicolas Copernicus Univ. of Torun (Poland). Inst. of Biology; and Nicolas Copernicus Univ. of Torun (Poland). Lab. of Microbiology.

Edmund Strzelczyk, and Andrzej Mielczarek. Hydrobiologia, Vol 38, No 1, p 67-77, 1971. 7 fig,

Descriptors: \*Aquatic environment, \*Metabolism, \*Bacteria, Plankton, Benthic flora, Lakes, Cultures, Rhizosphere.

Idlentifiers: \*Epiphytic bacteria, \*Lake Jeziorak (Poland), Chromogens, Casamino acids, Glucose, Succinate, Fumarate, Gluconate, Acetate, Fructose, Pyruvate.

For better characterization of plankton, benthic, and epiphytic bacteria, a more comprehensive evaluation was made of the metabolic behavior on substrates most often used in respiratory studies and possibly occuring in natural environments. Samples of surface water, of mud, and of Canadian pondweed were taken from Lake Jeziorak (Po-land). Seven substrates, glucose, fructose, sodium acetate, -pyruvate, fumarate, -gluconate, and casamino acids were used in respirometric studies. The epiphytic bacteria showed the greatest metabolic activity in every instance; benthic bacteria were least active, and the water isolates were intermediate. Non-chromogenic bacteria were metabolically more active than the chromogens. Casamino acids proved the most readily oxidized substrate among the compounds studied. Glucose,

succinate, fumarate and gluconate were readily used by most epiphytic and planktonic bacteria. Acetate was intermediate and fructose was the least suitable substrate for these organisms. Casamino acids proved to be the best substrate for all three groups, although the benthic bacteria were less active with this substrate than the other two groups. Gluconate, succinate, pyruvate and acetate were intermediate, and glucose and fructose were least suitable for most of the benthic bacteria. (Jones-Wisconsin) W72-01371

RELATIONSHIP BETWEEN NUTRIENT AVAILABILITY AND CONTENT OF NITROGEN AND PHOSPHORUS IN TISSUES OF THE AQUATIC MACROPHYTE, EICHORNIA CRASSIPES (MART) SOLMS,

Southwest Texas State Univ., San Marcos. Dept. of Biology. D. R. Gossett, and W. E. Norris, Jr.

Hydrobiologia, Vol 38, No 1, p 15-28, 1971. 7 fig,

Descriptors: \*Aquatic plants, \*Water hyacinth, \*Nutrients, Plant growth, Nitrogen, Phosphorus, Laboratory tests, Bioindicators, Water quality. Identifiers: Eichhornia crassipes, Tissue analysis, Guadalupe River (Texas).

Samples of common water hyacinth, Eichhornia crassipes, were collected from the Guadalupe River, Texas, and from laboratory hydroponic cultures containing varying concentrations of nitrate and phosphate. Analyses of blades, floats, and roots of plants showed a positive correlation of their nitrogen and phosphorus contents with those of their growing media. Results obtained with analyses of laboratory cultured plants suggested a luxury storage of the two elements in the floats. Tissue analyses are recommended for appraisal of the nutrient status of lakes and streams. (Wilde-Wisconsin) W72-01372

# NITROGENASE ACTIVITY IN WISCONSIN LAKES OF DIFFERING DEGREES OF EUTROPHICATION,

Wisconsin Univ., Madison. Water Resources W. D. P. Stewart, T. Mague, G. P. Fitzgerald, and

R. H. Burris. New Phytology, Vol 70, p 497-509, 1971. 5 fig, 9 tab, 24 ref. OWRR B-020-WIS (4) and OWRR B-

Descriptors: \*Nitrogen fixation, \*Eutrophication,

Oligotrophy, Diurnal, Analytical methods, Nitrogen, Lakes, Wisconsin. Identifiers: "Acetylene reduction, "Kjeldahl digestion, "Nesslerization, Lake Mendota, Lake Mary, Little Arbor Vitae Lake, Crystal Lake, Trout Lake, Green Bay of Lake Michigan, Heterocystous algae, Gloeotrichia, Aphanizomenon, Anabaena.

Nitrogen fixation in various Wisconsin lakes was compared using the acetylene reduction technique. Rates of acetylene reduction were unaffected by N2 when sufficient acetylene was added to the gas phase. Thus in field studies the natural gas phase need not be removed before the addition of acetylene. Acetylene was reduced rapidly in eutrophic waters (Little Arbor Vitae Lake, Lake Mendota, and southern Green Bay) but more slowly in oligotrophic waters (Crystal Lake, Trout Lake, Lake Mary, and northern Green Bay). Acetylene reduction was greatest in the surface waters, was largely light-dependent and showed a marked diurnal variation. There was also significant variation with area and with time, and in general acetylene reduction was detected only when heterocystous algae were present. The rate of nitrogen fixation in Lake Mendota, calculated on the basis of weekly measurements taken during most of the ice-free season, was approximately 2.4 kg/ha/year. A direct correlation was confirmed by the study between the abundance of heterocystous

(Gloeotrichia, Aphanizomenon, Anabaena) and the acetylene reducing capacity of W72-01373

CROSS-SECTIONAL STUDY OF THE EFFECTS OF SMELTER WASTEWATER DISPOSAL ON WATER QUALITY OF THE COLUMBIA RIVER DOWNSTREAM FROM TRAIL, BRITISH COLUMBIA,

Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Water Branch. For primary bibliographic entry see Field 05B. W72-01424

# BIOLOGICAL ASPECTS OF WATER POLLU-

TION, National Inst. of Water Research, Pretoria (South

R. G. Noble, W. A. Pretorius, and F. M. Chutter. South African Journal of Science, Vol. 67, No. 3, p. 132-136, March 1971.

Descriptors: \*Water pollution effects, \*Organic wastes, \*Nutrients, \*Pollutant identification, Algae, Aquatic bacteria, Sewage bacteria, Environmental effects, Biological communities, Heavy metals, Herbicides, Toxins, Waste dilution, Nitrogen, Phosphorus, Eutrophication, Surface

Although organic wastes are mainly non-toxic, the processes involved in their decomposition in water may create conditions such as anaerobiosis and ammonia and sulphide accumulations which are highly toxic. Sewage, industrial wastes and agricultural runoff also contain high levels of nitrates and tural runoff also contain high levels of nitrates and phosphates which promote the growth of algae and hydrophytes, leading to highly destructive effects in natural waters. In recent years toxic substances such as herbicides and heavy metal ions have appeared in high quantities. Although they act in different ways, poisons and nutrients have strikingly similar effects on biological communities. In both cases lead environments are altered radically cases, local environments are altered radically enough so that only relatively few species survive. In aquatic exosystems such low species diversities result in low ecosystem stability so that many of the processes in water self-purification are no longer operative. Bacteriological, algolgical and faunal easures of pollution are discussed. Since the combatting of pollutants is extremely difficult once they have been released into waterways; their early de tection is important. (Casey-Arizona) W72-01472

#### BIOLOGICAL LIFE IN WATER,

National Inst. for Water Research, Pretoria (South

B. J. Cholnoky. South African Journal of Science, Vol 67, No. 3, p. 128-131, March 1971.

Descriptors: \*Pollutant identification, \*Aquatic plants, \*Aqueous solutions, \*Biological properties, Molecular structure, Permeability, Plant populations, Algae, Chemical properties, Water pollution, Protein, Primary productivity.

\*Chemical Identifiers: \*Macromolecules.

The broad trends of chemical evolution are reviewed. The processes involved in macromolecule synthesis developed and operate only in aqueous solutions. As large electrically charged molecules accumulated, water dipoles became oriented, creating groups of particles or micelles, and molecularly disperse solutions were prevented. Mechanisms of 'duplication' by the integration of dissolved molecules of different types into the structures of new macromolecules were developed through the harnessing of radiant energy leading to the primary producers, the green plants. Eventually, other plant forms evolved which were at least partially dependent on dissolved organic molecules from primary producers, and finally,

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### WATER QUALITY MANAGEMENT AND PROTECTION-Field 05

#### Waste Treatment Processes—Group 5D

animals evolved, who are totally dependent on pri-mary producers. A major difference between aquatic primary producers, such as algae, and all other life forms, is the necessity for extremely selective permeability mechanisms in the primary producers to facilitate selective uptake of the imortant inorganic molecules that serve as building portant inorganic molecules that serve as blocks of macromolecules. It is therefore argued that this property confers a greater reliability on green plants as water pollution indicators. We are still inclined to overestimate the importance of bacteria and to underestimate the importance of bacteria and to underestimate the importance of algae. (Casey-Arizona) W72-01473

# THE EFFECTS OF PESTICIDES ON WATER RESOURCE DEVELOPMENTS.

Proceedings of Joint Meeting of the Arkansas-White-Red Basins Inter-Agency Committee and the Southeast Basins Inter-Agency Committee, April 22, 1970, New Orleans, La. 84 p.

Descriptors: \*Water pollution sources, \*Pesticides, Descriptors: Water pollution sources, "Pesticites, "Conferences, "Water pollution effects, Reviews, Water resources development, Surface waters, Groundwater, Estuaries, DDT, Environmental ef-Glouisvater, Estuates, DD1, Elwinimental effects, Ecology, Agriculture, Path of pollutants, Water quality control.

Identifiers: \*Conference on pesticides (New Orle-

ans. La).

Six papers concerning the effects of pesticides on Sax papers concerning the effects of pesticides on water resource developments were presented at the joint meeting of the Arkansas-White-Red-Basins Inter-Agency Committee and the Southeast Basin Inter-Agency Committee in New Orleans, La. on April 22, 1970. The panel on pesticides was developed in an attempt to clarify the situation regarding the use of pesticides, particulary in and near water resources. Panel members were high level experts drawn from the Louisiana Stream Control Commission, the pesticide industry, the U.S. Department of Agriculture, the U.S. Fish and Wildlife Service, the Federal Water Quality Administration, and the U. S. Public Health Service. Each speaker had played a significant part in establishing policy and controls on the use of pesticides, and gave their views and agency policies. (See also W72-01518) (Woodard-USGS) W72-01517

# AGRICULTURAL ASPECTS OF THE EFFECTS OF PESTICIDES IN WATER RESOURCE DEVELOPMENTS,

Agricultural Research Service, Washington, D.C. K. C. Walker.

In: The Effects of Pesticides on Water Resource Developments, Proceedings of Joint Meeting of the Arkansas-White-Red Basins Inter-Agency Committee and the Southeast Basins Inter-Agency Committee, April 22, 1970, New Orleans, La., p 36-43.

Descriptors: \*Water pollution sources, \*Pesticides, Water pollution effects, Reviews, Surface waters, Groundwater, Agriculture, Forestry, Weed control, Ecology, Environmental effects, Water quality control, DDT.

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The areas of the country devoted primarily to agriculture and forestry are the major sources of water. These areas are also major users of various pesticides. In 1966 about 37% of the farmers growing crops used herbicides, 29% used insecticides, 4% used fungicides, and 8% used other pesticides such as growth-regulators, miticides, and rodenticides. When a pest strikes, it is not trees alone that are lost. Destruction of timber results in severe damage to property, soil and water supplies. Trees and underbrush are essential to effective protection from floods and preservation of water supply reservoirs. Defoliation of wooded areas reduces the soil water holding capacity, contributes to erosion and the accompanying water pollution, and damages the recreation and wildlife aspects of the areas. Persistent pesticides should not be used in pest control programs when an effective, nonresidual method of control is available. When persistent pesticides are necessary to combat pests, they should be used in minimal effective amounts, applied precisely to the infested area, and at minimal effective frequencies. (See also W72-01518) (Woodard-USGS) W72-01519

11TH TECH MEETING OF THE INTERNAT'L UNION FOR NATURE CONSERVATION AND NATURAL RESOURCES, 1ST AND 2ND SES-SIONS. COMMISSION ON ECOLOGY SECTION ON EFFECTS OF POLLUTION ON NATURAL ECOSYSTEMS. NEW-DELHI, INDIA, NOVEM BER 15-28, 1969, J. B. Cragg.

IUCN (Int Union Conserv Nature Natur Resour)
Publ N S. 17: 1970. 76-115. (See also W72-01600 thru W72-01602).

Identifiers: Commission, Conservation, Ecology, Ecosystems, India, International, Meeting, Natural, Nature, Nd, New-Delhi, Pollution, Resources, Section, Sessions, St, Symposium, Technical, Th, W72-01599

#### THE ECOLOGICAL IMPACT OF POLLUTION. N. W. Moore.

IUCN (Int Union Conserv Nature Natur Resour) Publ N S. 17: 1970. 76-81.

Identifiers: Aquatic, Ecological, Impact, Insecticides, Pesticides, Pollution, Systems.
W72-01600

#### ORGANO CHLORINE POLLUTION OF RIVERS AND THE HERON ARDEA-CINEREA,

I. Prestt. Publ N S. 17: 1970. 95-102.

Identifiers: Ardea-Cinerea, Chlorine, Heron, Insecticides, Organo, Pollution, Rivers. W72-01601

#### EFFECTS OF DERIVED FROM UREA ON FISH AND THEIR FOOD.

A. V. Denisova, G. V. Popova, and I. G. Pushkar. IUCN (Int Union Conserv Nature Natur Resour) Publ N S. 17: 1970. 103-106. Identifiers: Chronic, Derived, Fish, Food, Herbicides, Pesticide, Pollution, Urea. W72-01602

# HETEROTROPHIC ACTIVITIES OF NATURAL MICROBIAL COMMUNITIES IN SEDIMENT

L. W. Wood. Elisha Mitchell Sci Soc. 86 (4): 1970. 169. Identifiers: Acetate, Communities, Cores, Creek, Estuary, Glucose, Heterotrophic, Microbial, Natural, North-Carolina, Sediment, Sediments, Trawling. W72-01605

#### DDT METABOLIZED BY MICROORGANISMS FROM LAKE MICHIGAN,

F. Matsumura, K. C. Patil, and G. M. Boush. Nature (London). 230 (5292): 1971, 325-326. Identifiers: DDT, Lake, Metabolized, Michigan, Microorganisms. W72-01608

# A REVIEW OF CHEMICAL AND TECHNOLOGICAL PRINCIPLES INVOLVED IN THE EUTROPHICATION OF NATURAL WATERS.

J Colo Wyo Acad Sci. 7 (1): 1970.8. Identifiers: Chemical, Estuaries, Eutrophication, Fish, Natural, Pollution, Ponds, Principles, Review, Technological. W72-01610

# PRIMARY PRODUCTIVITY OF PHYTOPLANK-TON IN HORSETOOTH COLORADO, 1963-1965,

J Colo Wyo Acad Sci. 7 (1): 1970.8. Identifiers: Carbon-14, Colorado, Horsetooth, Method, Phyto, Plankton, Primary, Productivity, W72-01611

# COLORADO ENDORHEIC LAKES: A STUDY OF CONTRASTS,

J Colo Wyo Acad Sci. 7 (1): 1970. 8-9. Identifiers: Chemistry, Colorado, Contrasts, Endor-heic, Fish, Lakes, Phyto, Plankton, USA, Water, W72-01612

# PHYSICAL PROCESSING CHARACTERISTICS OF SOME AQUATIC MACROPHYTES AS RE-LATED TO MECHANICAL HARVESTING, Wisconsin Univ., Madison. Water Resources

F. O. Aboaba. Ph.D. Thesis, 1971. 257 p, 116 fig, 3 tab, 62 ref, 7 append. OWRR B-018-WIS (3).

Descriptors: \*Aquatic plants, \*Permeability, \*Dewatering, \*Darcys law, \*Harvesting, Filtration, Eutrophication, Aquatic weed control. Identifiers: \*Mechanical harvesting, \*Milfoil, \*Myriophyllum spp., \*Fluidizing, \*Blanching, Combustion properties, Compression properties, Hammer mill, Screw press.

Alternative mechanical processing procedures are described to simplify the harvesting of aquatic plants and possibly eliminate the second barge used in the current single-stage harvesting scheme. The physical characteristics of the vegetation were evaluated. Milfoil was found to have a specific gravity of 1.515, a unit weight of 49.42 lbs./cu.ft., a bulk density of 12.9 lbs./cu.ft., and heat energy of about 5,500 BTU/lb. Alternative physical processes tested included (1) fluidizing with a hammer mill (1/4 to 1/7 volume reduction), (2) combustion at 65 per cent moisture content (wet basis), (3) compression (compression index of 0.8), (4) blanching before dewatering, and (5) filtering. Passing aquatic vegetation between high pressure rolls ap-peared to offer effective dewatering at high capacities with low power consumption and produce sub-stantial volumetric reduction. Exploratory tests with screw presses indicated that, with a second pass through the press, 78 per cent of the original material was removed as liquid. W72-01640

#### STATEMENT IN SUPPORT OF THE CLEAN LAKES ACT OF 1971,

Senate, Washington, D.C.
For primary bibliographic entry see Field 06E.
W72-01660

#### 5D. Waste Treatment Processes

# LOW-COST WATER TREATMENT SOLVES DISPOSAL PROBLEMS.

Gulf Oil Co, Bakersfield, Calif. J. K. Beckett. World Oil, Vol 173, No 6, p 64-67, November 1971. 4 fig.

Descriptors: \*Water pollution treatment, \*Oily water, \*Water quality control, \*Oil industry, Methodology, Equipment, Costs, Filters, Floccula-tion, Chemical reactions, Oil-water interfaces.

A 10,000-bwpd capacity produced-water treating facility is reducing oil contamination to below stric-test pollution control levels for less than one cent per barrel. Flotation cells were combined with shipmodified surplus lease equipment to provide a highly effective, minimum cost purification system.

#### Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

## **Group 5D—Waste Treatment Processes**

Beyond primary separation in tanks aided by chemicals and some heat, most oil and solids removal occurs in the 4-cell Model 56 WEMCO Depurator (purifier), a skid-mounted natural ga charged impeller-educator unit. Two sand-filled final filters further purify water before entering the treated water tank. Filter backwashing is done manually each 7-8 days on a schedule determined by routine effluent testing. Chemical fluid treatment is used to assist the purifer and filters. Heavier crudes require electrolyte assistance for maximum oil-water separation in surge and treater tanks. Additional electrolyte is added ahead of the Depurator. Operating costs for treating surge tank and treater water, up to the suction of water injection pumps, are estimated at 0.76 cents per barrel of water. (Woodard-USGS) W72-01146

EFFECT OF PRESYNTHESIZED BIOLOGICAL INTERMEDIATES ON SUBSTRATE UTILIZA-

Missouri Univ., Columbia. Dept. of Civil Engineer-

Available from the National Technical Information Service as PB-204 494, \$3.00 in paper copy, \$0.95 1971. 59 p, 15 fig, 6 tab, 16 ref, append. OWRR A-039-MO (1).

Descriptors: \*Biological treatment, \*Anaerobic digestion, Methane bacteria, \*Waste water treat-ment, Design, Bacteria, Microorganisms. Microorganisms. \*Degradation (Decomposition), Microbiology. Identifiers: \*Substrates, Pure substrates, Organic substrates.

The design of biological waste treatment systems is frequently based upon the microbial rate of degradation of pure organic substrates. In the case of anaerobic digesters, these rates are frequently obtained by measuring the degradation rate of short chain fatty acids. In this study anaerobic methane bacteria were fed acetic acid in the presence of other biological growth intermediates. In almost all instances the acetic acid degradation rate was greater in the presence of extraneous substrates and greatest in the presence of lysed microorganisms. It was concluded that (a) microbial kinetic values obtained for pure substrates are not applicable to mixed substrate systems and (b) microbial growth rates can be enhanced by recirculation of lysed microorganisms or by feeding a more concentrated mixed substrate. W72-01336

#### **ENVIRONMENTAL FACTORS IN DESIGN AND** OPERATION OF WASTE WATER SLUDGE DRYING BEDS,

Missouri Univ., Rolla. Water Resources Research Center.

J. Charles Jennett, and Daniel J. Harris.

Available from the National Technical Information Service as PB-204 599, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, October 101 p, 10 fig, 20 tab, 18 ref, 2 append. OWRR A-042-MO (1).

Descriptors: \*Drying, \*Sludge, \*Sewage treatment, Sludge disposal, "Waste water treatment, Filtra-tion, Dewatering, Activated sludge. Identifiers: Sludge drying, Sand filtration.

The dewatering characteristics of anaerobically digested primary and activated sludge were investigated under eight selected combinations of laboratory controlled air temperature and relative humidity using three open, drained model beds, as well as a closed, drained and an open, nondrained bed. The evaporation rate from a free water surface was also determined. Moisture content, drainage, evaporative weight loss, and sludge surface reces-sion were measured and recorded periodically throughout the two week period of each of the eight experiments. Relationships were shown to exist between sludge moisture content, evaporation rate from a free water surface, and the parameters T (the difference between dry and wet bulb tem-perature and H (the difference between saturation and absolute humidity). It was found that moisture gradients developed within the dewatering sludge which generally increased with time and T. An inverse relationship was noted between drains evaporation which was influenced by dry bulb temperature because of its effect upon water viscosity. W72-01337

THE USE OF ANAEROBIC FILTERS FOR THE RENOVATION OF ACIDIC WASTEWATERS, Missouri Univ., Rolla. Water Resources Research

Center.

Available from the National Technical Information Service as PB-204 544, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, June 30, 1971. 23 p, 4 fig, 4 ref, append. OWRR A-034-MO (1).

Descriptors: \*Anaerobic digestion, Industrial wastes, \*Waste water treatment, \*Filters, Filtra-tion, \*Methane bacteria, \*Acidic water, Hydrogen ion concentration

Identifiers: \*Acidic wastes, pH response, Anaero-

Pilot and laboratory studies were conducted in which acidic wastes were fed to an established anaerobic filter. The renovation of organically polluted acidic wastewaters was demonstrated and the applicability of the process detailed. Pilot studies would be required for the design of field installations and specific wastes. The anaerobic process and the methane bacteria are apparently more pH tolerant than generally recognized. W72-01339

FACILITIES. POLLUTION CONTROL. GUIDELINES FOR CERTIFICATION. Environmental Protection Agency, Washington,

For primary bibliographic entry see Field 06E. W72-01357

COMPARISON OF ENERGY FLOW PARAME-TERS OF MIDGE POPULATIONS IN BIOLOGI-

CAL OXIDATION PONDS, Oklahoma Water Resources Research Inst., Still-

water. Jerry Wilhm.

Available from the National Technical Information Service as PB-204 524, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, October 1971. 46 p, 10 fig, 12 tab, 59 ref. OWRR A-018-OKLA

Descriptors: Laboratory tests, \*Midges, \*Oxidation lagoons, Invertebrates, Phenols, Sodium chloride, Dissolved oxygen, Temperature, Hydrogen ion concentration, Storage, Transportation, Sampling, Waste water treatment, Biological treatment,

Identifiers: \*Energy flow parameters, \*Caloric content, Haemolymph, TLm, Chironomus attenuatus Wlaker.

A laboratory population of fourth-instar larval forms of Chironomus attenuatus Wlaker received a continuous life-long exposure of 0, 3, 8, 11, 16 and 22 ppm phenol. Water temperature, pH and dissolved oxygen concentration were monitored. Exposed larvae were analyzed for oven-dry weight, ash-free weight, caloric content, and oxygen uptake. Caloric content per gram in larvae ir with increasing phenol content up to a maximum of 5,869 cal/g in larvae exposed to 16 ppm phenols. Maximum oxygen uptake was 2.26 1/mg/hr in larvae exposed to 11 ppm phenols. Linear equations were formulated to relate energy content to phenol level and energy content and distance downstream from an outfall. Larvae were also exposed to 6 different salt concentrations between 0 and 342 mM/1 for 4 different time periods. 12 hour TLm was 171 mM/1, and mortality of larvae exposed for 12, 24, and 36 hours was low at the three lower salt concentrations and equated or approached 100% at the higher levels. Concentration of sodium in the emolymph was similar in larvae exposed to the lower concentrations and increased progressively at the three higher concentrations, while chloride levels increased steadily with increasing salt concentration. Maximum caloric content was 7295 cal/ash-free gram at 68.4 mM/1 NaCl. (Lowry-Tex-W72-01492

ADVANCED WASTEWATER TREATMENT AS PRACTICED AT SOUTH TAHOE

South Tahoe Public Utility District, South Lake Tahoe, Calif.

Russell L. Culp, Jerry C. Wilson, and David R Evans.

Copy available from GPO Sup Doc 2.10: 17010 ELQ 08/71, \$3.25; microfiche from NTIS as PB-204 525, \$0.95. Environmental Protection Agency - Water Quality Office, Water Pollution Control Research Series, August 1971. 436 p, 92 fig, 78 tab, 42 ref. EPA Program 17010 ELQ 08/71, WPRD 52-01-67.

Descriptors: \*Waste water treatment, \*Tertiary treatment, \*Water reuse, Lime, Chemical precipitation, Activated carbon, Adsorption, Filtration, Sludge disposal, Incineration, Water qualicontrol, Cost analysis, California, Nutrients,

\*Lime recalcination, regeneration, \*Lake Tahoe (Calif), Ammonia stripping.

A 7.5 mgd advanced wastewater treatment plant at South Lake Tahoe, California has been in uninterrupted operation for three years. Chemical treatment, mixed media filtration, and granular carbon adsorption have been shown to be efficient, reliable, and economical processes for wastewater treatment. A degree of reliability and flexibility comparable to that achieved in electric power generation and water purification has been achieved by appropriate selection and sequencing of unit processes and proper plant design. Plant bypasses have been eliminated. Bacteria and viruses have been entirely eliminated from the effluent by small chlorine dosages. Lime has been re-calcined in a multiple hearth furnace without air pollution, and granular activated carbon has been successfully regenerated and reused, with stack gasses scrubbed to meet air pollution standards. The entire plant produces only clean water, sterile ash, and harmless gases. Reclaim ed wastewater has been used to form a recreational lake, certified for water contact sports by regular testing, and free of algal blooms. The wastewater treatment cost has been approximately twice the cost of conventional wastewater treatment, but the project has demonstrated that man's wastes need no longer degrade the environment if genuine desire and determina-tion to solve the problem is applied. (Lowry-Texas) W72-01493

THE ELECTRO-OXIDATION OF AMMONIA IN SEWAGE TO NITROGEN, Ionics, Inc., Watertown, Mass

Ljiljana Marincic, and Frank B. Leitz. Copy available from GPO Sup Doc as EP 2.10: 17010 EED 07/70, \$0.55; microfiche from NTIS as PB-204 526, \$0.95. Environmental Protection Agency - Water Quality Office, July 1970. 47 p, 19 fig, 10 tab, 11 ref. EPA Program 17010 EED 07/70, Contract 14-12-800.

Descriptors: \*Oxidation, currents, Electrodes, Catalysts, Nitrogen, feasibility, Economic feasibility, Analytical techniques, Tertiary treatment, \*Waste water treatment, Laboratory tests, Sewage: Identifiers: \*Electro-oxidation, Platinum.

aboratory tests were conducted to determine the feasibiluty of electro-oxidation as a means of removal of ammonia from wastewaters. It was determined that, under conditions of ammonia

fluents. tion pro tions as occurre lombic exchang nitrogen by analy hydroxy power c but cost Experim ful. Unle the proc W72-01

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polystyre wastewat bases and aliphatic contact w 8.0. The with alkal Amidiniu tracts niti about 20 phase is a aqueous p systems w nicipal wa nicipal wa breakthro Processing cents/100 W72-0149

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concentration and pH typical of treatment ef-fluents, the electro-oxidation reaction proceeded stoichiometrically to nitrogen and no other oxidation products. Oxidation occurred in concentrations as low as 2 mg/l of ammonia. Using platinized platinum as an electrode, ammonia decomposition occurred in a narrow potential range with high cou-lombic efficiency, assuming a three-electron exchange per ammonia molecule. Conversion of nitrogen to the elemental form was demonstrated by analysis of the gas from the anode. No detectable quantities of nitrite, nitrate hydraxine, and hydroxylamine were discovered in the gas. Electric power costs were estimated at \$.01/1000 gallons, but cost of the platinum electrodes was prohibitive. Experiments with other electrodes were unsuccessful. Unless less expensive electrodes are developed, the process cannot be economically competetive with other methods. (Lowry-Texas)

# NITRATE REMOVAL FROM WASTEWATERS

BY ION EXCHANGE,
Dow Chemical Co., Walnut Creek, Calif.
Robert R. Grinstead, and Kenneth C. Jones. Copy available from GPO Sup Doc as EP 2.10: 17010 FSJ 01/71, \$1.00; microfiche from NTIS as PB-204 527, \$0.95. Environmental Protection rg-204 321, \$0.95. Environmental Protection Agency - Water Quality Office, Water Pollution Control Research Series, January 1971. 99 p, 13 fig, 15 tab, 50 ref. EPA Program 17010 FSJ 01/71, Contract 14-12-808.

Descriptors: \*Denitrification, \*Anion exchange, Nitrate, \*Separation techniques, Ion exchange, Absorption, Evaporation, Ammonia, Tertiary treatment, Cost analysis, \*Waste water treatment, Municipal wastes, Resins, Solvent extractions. Identifiers: \*Amidines, \*Regeneration, Sodium

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Alkylated amidines dissolved in an aromatic hydrocarbon were absorbed in macro-porous polystyrene beads to form a water-immisciole extractant system for the removal of nitrate from wastewaters. The amidines are relatively strong bases and possess the advantage over the simple aliphatic amines that they exist in the salt form in contact with wastewaters in the pH range of 7.0 to 8.0. They can, however, be readily regenerated with alkalis, such as ammonia or sodium hydroxide. Amidinium ion in the organic phase selectively ex-tracts nitrate ion over chloride ion by a factor of about 20 (nitrate/chloride ratio in the organic phase is about 20 times the ratio in the equilibrium aqueous phase), and nitrate over sulfate and bicar-bonate by much higher ratios. Therefore, amidine systems will pick up mainly nitrate ion from mu-nicipal wastes. 70 bed volumes of a synthetic municipal wastewater containing 62 ppm nitrate ion and 350 ppm chloride ion were treated before breakthrough of nitrate ion in the effluent. Processing costs were estimated currently at 16 cents/1000 gal. (Lowry-Texas)
W72-01495

U. S. ARMY TEST AND EVALUATION COMMAND COMMODITY ENGINEERING TESTS PROCEDURE WATER SUPPLY AND TREATMENT EQUIPMENT.

Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

Available from National Technical Information Service as AD-726 911, \$3.00 in paper copy, \$0.95 in microfiche. Material Test Procedure 9-2-270, General Equipment Test Activity, May 27, 1971. 38 p, 1 fig, 1 tab, 68 ref.

Descriptors: \*Water purification, \*Performance, \*Reliability, \*Waste water treatment, On-site tests, Evaluation, Laboratory tests, Coagulation, Filtration, Adsorption, Chlorination, Odors, Bacteria. Identifiers: \*Suspended solids.

Test methodology and testing techniques are outlined for water purification systems. The systems are designed to remove undesirable material by coagulation, settling and filtering. Bacteria is rendered harmless by chlorination and charcoal is used to remove odors and tastes. Water purification equipment ranging from semi-permanent plant installation, truck and trailer mounting, portable type base and from units, to small hand operated systems was tested to determine the technical performance and safety characteristics, and to de mine the items suitability for service tests. The procedure described includes: (1) pre-test inspection and physical characteristics determination; (2) performance of unit; (3) performance of available kits furnished with the unit; (4) accelerated climatic and environmental condition effects; (5) electromagnetic interference characteristics evaluation; (6) durability tests; (7) transportability tests; (8) maintenance evaluation; (9) reliability tests; (10) safety tests; (11) human factors tests; (12) value analysis; and (13) quality assurance. (Lowry-Texas) W72-01496

HIGH-RATE BIOLOGICAL FILTRATION: A COMPARATIVE ASSESSMENT, Watson (J. D. and D. M.), London (England).

J. R. Joslin, J. M. Sidwick, G. Greene, and J. R. Shearer.

Water Pollution Control, Vol 70, No 3, 1971. p 383-394, 5 fig, 9 tab, 15 ref.

Descriptors: \*Filtration, \*Pilot plants, \*Organic loading, Biochemical oxygen demand, Sampling, Monitoring, Feasibility studies, Cost-benefit analysis, Granites, \*Waste water treatment, \*Treatment facilities, Sewage treatment.

Identifiers: \*Synthetic filter medium, Flocor, Surfpac, Slag, Hydraulic loading.

Two existing sewage treatment plants utilizing conventional biological filtration were becoming over-loaded and unable to meet discharge criteria set up by the Trent River Authority. Land considerations made it economically unfeasible to merely expand the number of filters, and high-rate biological filters were designed and implemented instead as roughing filters. In both cases the objective was to reduce the organic loading on the conventional filters by about 50%. Filter media used included Flocor (PVC) synthetic medium, Surfpac (Polystyrene) medium, both crinkle close and regular, and nominal slag and nominal granite of varying dimensions. Results obtained from opera-tion of experimental plants at both locations demonstrated that the high-rate filters were capable of producing an effluent with a BOD of less than 200 mg/l, with only 3.5% of the samples from the filter effluents being in excess of 200 mg/l BOD. Comparisons of the individual filters demonstrated the synthetic medium is the more cost-effective, but extensive analyses have yet to be per-formed. Several other installations are mentioned briefly. (Lowry-Texas) W72-01498

# REMOVAL OF COLLOIDAL-AND SOLUTION--PHASE IMPURITIES FROM TRICKLING FILTER EFFLUENTS BY COAGULATION,

Clemson Univ., S. C. Waldron M. McLellon, Chia-chen Chao, and Thomas M. Keinath.

Paper presented at Water Pollution Control Federation, Conference, 43rd, Boston, Massachusetts, October 6, 1970. 41 p, 15 fig, 33 ref. OWRR A-012-SC (3).

Descriptors: \*Coagulation, \*Trickling filters, \*Tertiary treatment, Colloids, Iron, Aluminum, Zeta potential, Sedimentation, Nitrogen, Phosphorus, Bacteria, \*Waste water treatment. Identifiers: \*Destabilization.

Laboratory scale coagulation experiments were performed on trickling filter effluents to determine the feasibility, both technological and economic, of adding coagulation after certain treatment schemes as a polishing step. Results indicated that chemical

coagulation with salts of A (III) and Fe (III) can complement and substantially enhance the treatment efficiencies of existing treatment facilities. Effective removals of hydrophilic organic colloids were achieved with the Fe (III) congulant at pH levels nominally below 6.45 while complete resta-bilization was noted for pH values less than 4.0. pH and alkalinity were the primary controllers of the destabilization-restabilization reactions. 70 to 90% COD removals were consistently obtained, with virtually all of the COD removed being initially present in the particulate form. Approximately 99.9% of the bacteria in solution were destabilized and removed concurrent with the other colloidal matter. Essentially 35% of nitrogen and 99% of the phosphorus present were removed at the optimum coagulant dosage. High operating and low capital costs, ability to be placed on line instantaneously, and ease of control make the process highly suited for application in instances requiring high-level ent at certain critical times. Costs for coagulation treatment of the trickling filter studied were estimated at \$.03/1000 gal. (Lowry-Texas) W72-01499

#### UTILIZATION OF ENVIRONMENTAL EN-GINEERING ADVANCEMENTS,

Clemson Univ., S. C. Benjamin C. Dysart, III.

Paper presented to South Carolina Society of Professional Engineers, Columbia Chapter, Colum-bia, South Carolina, November 2, 1970. 9 p. OWRR B-017-SC (3).

Descriptors: \*Waste water treatment, \*Research and development, \*Pollution abatement, \*Water quality control, Legislation, Federal government, State government, Technical feasibility, Economic analysis, Technology.

Identifiers: \*Regulatory agencies, \*Engineering

firms. Fees.

Great advances have been made in nearly every technological area, with wastewater treatment technology being no exception. However, most of the advances made in other fields have been applied with astounding results, while wastewater treatment plants have been only slightly changed since the 1930's. Both regulatory agencies and enterprise from have been character for gineering firms have been reluctant to deviate from the old established methods to try new concepts. Despite the expenditure of \$5.4 billion for waste-water treatment facilities since 1957, the nation's waterways have remained as badly polluted as previously, if the water quality has not actually been degraded further. Federal funds will no longer be expended for concrete and steel out-dated structures, but for performance and pollution abatement. Engineering firms must begin to incorporate the new technology into environmental projects, or they will be phased out like the conventional structures they have built. The public must receive the greatest amount of pollution abatement for the dol-lar they spend if water quality is to be improved. (Lowry-Texas) (Lowry-Texa W72-01500

DEPARTMENT OF THE NAVY, ENVIRONMEN-DEPARTMENT OF THE NAVY, ENVIRONMENTAL IMPACT STATEMENT (DRAFT), NAVAL AIR STATION, LEMOORE, CALIF., SEWAGE DISPOSAL FACILITY (LAND ACQUISITION PORTION ONLY) FY 72, MILITARY CONSTRUCTION PROGRAM, 1 APRIL 1971. Naval Air Station, Le Moore, Calif

Available from the National Technical Information Service as PB-199 018-D, \$3.00 in paper copy, \$0.95 in microfiche. Environmental Impact Statement on Land Acquisition for the Proposed Sewage Treatment Facility at the Naval Air Station, LeMoore, California. 35 p, 7 fig, 4 tab.

Descriptors: \*Separation techniques, Salts, \*Evaporation, Demineralization, Infiltration, Storm runoff, Sulfates, Boron, Irrigation, Cost anal-ysis, Transportation, \*Waste water treatment, California, \*Environmental effects.

# Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

## **Group 5D—Waste Treatment Processes**

Identifiers: \*King's River, Dissolved solids, Le Moore (Calif).

The administrative and Housing Area at the Naval Air Station in LeMoore, California is presently served by a conventional secondary treatment plant discharging its effluent to the King's River. The existing plant is not capable of removing the high concentration of sulfates, boron, and other inorganic materials present in the sewage. Storm sewer effluents were also determined to contain quantities of chemicals harmful to streams, largely due to the prevalent soil types and lawn watering practice. An engineering study comparing elec-trodialysis, ion exchange, distillation, and solar evaporation was conducted, and solar evaporation chosen as the most economical solution. An arid climate and impervious soil type made the proposed location particularly suitable. A total cost estimate of \$2,479,000 for acquisition of 440 acres of land from 22 owners and construction of the ponds was presented. By including oxidation lagoon sections, the former treatment plant could be by-passed at considerable savings. The proposed land is of only marginal productivity at present, and construction of the ponds will eliminate effluent discharges from the Naval Air Station to the King's River entirely. (Lowry-Texas) W72-01501

AUTHORITY SOLVES THE SEWERAGE

'CREDIT CRUNCH', Manganaro, Martin and Lincoln, New York.

Public Works, Vol 101, No 1, January 1970, p 74-

Descriptors: \*Waste water treatment, \*Sewers, Construction, Financial feasibility, Financing, Grants, Interest, Economic justification, Costs, \*Cost comparisons, New Jersey. \*Extensions, Municipal bonds, Current

income, Salem County (NJ).

Among those who have been hardest hit by the recent rise in interest rates on municipal bonds are sewerage authorities. The Pennsville Sewerage Authority in Salem County, New Jersey was faced with a situation where extensions of the existing collection system were required but the total cost for the improvements were beyond the means of the Authority due to the greatly increased interest rates. The Superintendent of the Authority, Howard H. Johnson, proposed to do the work 'inhouse' on a piece meal basis using current revenues. A limited, initial project was approved as a trial of the concept. Over 3,800 feet of 4, 6, and 8 inch sewer lines were laid at a total cost of \$21,005 or \$6.63 per foot. This is approximately 1/3 to 1/2 of the estimated costs had the work been contracted out with money raised by a bond issue. Receipts from the services provided by these improvements should pay for the costs in 4-5 years.

The Authority has made plans to complete the required extensions over a period of 7 1/2 years using general revenue to finance the work as it is It should be made clear that such a procedure can be used only when the talent is available and willing to do this sort of work and when the work to be done is within the capability of the talent at hand. (Goessling-Texas) W72-01502

CONCEPTS IN OPEN COASTAL DISPOSAL OF MUNICIPAL WASTEWATERS,

California State Water Resources Control Board, Sacramento.

Paul R. Bonderson, Fred McLaren, Ronald L. Church, Harry M. Scheulier, and Kurt L.

Wasserman.

Preprint, presented at Water Pollution Control Federation Conference, 44 Session, Oct 5, 1971. 36 p, 1 fig, 4 tab, 30 ref.

Descriptors: \*Oceans, \*Outlets, \*Municipal wastes, \*Industrial wastes, Toxicity, Heavy metals, Pesticides, Color, Turbidity, Public health, Sedi-

mentation, Chlorination, Biochemical oxygen demand, Dispersion, Waste water treatment, Waste Identifiers: \*Pretreatment.

A study of present practices with respect to ocean disposal of municipal wastes has indicated there is sufficient justification for requiring more than primary treatment of wastes discharged to open coastal waters. Source control and pretreatment were specified as the most effective and economical means of eliminating many conservative toxicants from waste effluents. Wastewater treatment facilities should provide essentially complete removal of environmentally hazardous substances which are not controlled at their source. Removal efficiencies for these substances are closely related to removal efficiencies for suspended, settleable, and floatable solids. Because of the increase in acute toxicity attributed to chlorination, chlorination should only be permitted in cases where applicable bacteriological standards cannot be met by long submerged outfalls with effective diffusion systems. These diffusion systems, although aesthetically and environmentally beneficial, in many instances, do not eliminate the need for greater removal efficiencies for conservative toxicants. (Lowry-Texas) W72-01504

WASTEWATER TREATMENT PROJECT, MUSKEGON COUNTY, MICHIGAN.

Environmental Protection Agency, Chicago, Ill.

Available from the National Technical Information Service as PB-200 348-F, \$3.00 in paper copy, \$0.95 in microfiche. Final Environmental Impact Statement, PB-200 348-F, June 25, 1971. 38 p, 7 fig. 6 tab.

Descriptors: \*Watershed management, \*Water quality control, \*Oxidation lagoons, Irrigation, Nitrates, Phosphates, Municipal wastes, Industrial wastes, Research and development, Michigan, \*Waste water treatment, \*Environmental effects. Identifiers: \*Regional wastewater treatment, \*Muskegon (Mich).

grant application was submitted by the Muskegon County Board and Department of Public Works, concerning a 43.36 MGD sewage treatment facility serving an initial population of 137,000 individuals. The proposed wastewater treatment scheme included an aerated waste stabilization pond-spray irrigation waste treatment facility. Discharge of municipal and major industrial wastes into Muskegon, Mona and White Lakes would be eliminated, and discharge of organic matter, suspended solids, heavy metals, phosphates, nitrates and pathogenic bacteria and viruses would be greatly reduced. In order to implement the plan, 200 families living within the proposed disposal site would have to be relocated. The beneficial environmental features of the plan not available in any alternative plans were deter-mined to override the adverse affects of relocating the 200 families, and the system was approved. (Lowry-Texas) W72-01505

CHLOROMET--ON SITE GENERATION OF HYPOCHLORITE.

Ionics Inc., Watertown, Mass. S. A. Michalek, and F. B. Leitz.

Preprint, presented at Water Pollution Control Federation Conference, 44th, Session 4, No 2, October 3, 1971. 34 p, 12 fig, 3 tab.

Descriptors: \*Chlorination, \*Storm runoff, \*Water Justin Properties and Separation techniques, Ion exchange, \*Membranes, Electric power costs, Cost analysis, \*Waste water treatment, \*Cation exchange, \*Electrolysis.

Identifiers: \*Combined sewer overflow, \*Sodium

hypochlorite, On-site generation.

An advanced electrolytic generator, the Cloromat, has been developed for on-site generation of sodi-um hypochlorite. An electrochemical cell elec-trolyzes sodium chloride brine to chlorine gas and sodium hydroxide solution, which are reacted immediately outside the cell to produce a 5 to 10% sodium hypochlorite solution. The most critical components, the dimensionally stable anode and the hydraulically impermeable cation exchange membrane, have withstood exposure to nascent wet chlorine for over 3,000 hours with no deterioration of physical properties or performance. At a current density of 240 ASF, cell potential is 3.7 volts. The unit requires 1.6 kwh of electricity and 2.1 lbs of salt per pound of sodium hypochlorite generated. Salt utilization is in excess of 80%. Operational costs for systems using more than 500 lbs of sodium hypochlorite per day are estimated 3 to 4 cents per pound of hypochlorite generated, based on average salt and power costs. A complete cost analysis for the system being tested at Somerville, Massachusetts are presented. Generation costs seem to be significantly lower than those for a commercially prepared and delivered product, making the process economically attractive in addition to being safer and more reliable. (Lowry-Tex-

as) W72-01506

PLASTIC LINER REPAIRS LEAKING SEWER, San Mateo City Engineers Office, Calif.

L. D. Johnson.

Public Works, Vol 101, No 6, June 1970, p 85-86,

Descriptors: \*Sewers, \*Outlets, \*Infiltration, \*Linings, \*Plastics, Tubes, Flexibility, Water pollution control, California. Identifiers: Inverted siphon, San Mateo (Calif)

As a part of a 54 inch sewer outfall, an inverted siphon was used to cross a slough in the path of the line. Due to soil conditions along the bottom of the slough, a flexible section was used for this siphon. Later inspection showed that the pipe had broken near one bank of the waterway and infiltration through this break could not be controlled. Inspection by divers found that the structure was sound except for the one break. From the several alternasolutions to this problem, the contractor elected to line the section of pipe with a plastic tube. Specifications for the linear provided for a PVC sheet sandwich reinforced with polyester fabric having a finished weight of 26 oz. per sq. yd. The liner was constructed in one continuous tube to fit the 54 in. line over the length of the siphon. The deflated plastic tube was pulled through the siphon manually by divers and fixed at both ends by steel circumferential hoops. The tube was 'inflated' by filling it with water which forced the infiltration water out of the pipe. Visual inspection of the tube indicated that the installation was sound and that no breaks had occurred. The outfall trunk sewer had been in operation for three months with success. No leaks in the siphon structure have been noted. This unique solution to a difficult problem money. (Goessling-Texas) W72-01507 has saved the contractor and the city time and

SEWER DESIGN AND COST ESTIMATION BY

Regional Planning Council, Baltimore, Md. A. G. Leary, and P. Zepp. Public Works, Vol 101, No 6, June 1970, p 90-91. 1 fig, 1 tab.

Descriptors: \*Sewers, \*Design, \*Computer program, Comparative costs, Alternative costs, Land use, Regional, Planning.

In evaluating alternative land use plans, it is desirable to design, cost and compare the sewer system associated with each alternative. If more than a few alternatives are under investigation, this can be a lengthy process. A computer program has been developed to allow the calculations alluded to

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treatment spores are because processes. digesters operated i such cond are: (1) present in numbers a dicate that process: (3 sludge dige present; (4 nembers o ganisms oc

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# WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

### Waste Treatment Processes—Group 5D

above to be completed in a matter of minutes. The program is presently written in 'Time Sharing Fortan' and is being run on a General Electric 265 time-sharing system. The sewer system is lagged out and numbered in a consistent manner. This system is entered into the computer with the land use type and area which is a tributary of each of the lines. The computer calculates the flows in each pipe, selects pipe size and determines cost for materials and construction. Flows are carried downstream for similar calculations for the lower sections of the system. Pumping stations are designed and costed where these are designated in the system. The output of this program include design data for each of the lines and for each pumping station under consideration; unit costs, incremental costs between nodes; and total cumulative costs throughout the total system. Future costs implied by such commitments as maintenance, operation and replacements for a period of fifty years, are discounted to the present using an appropriate interest rate. (Goessling-Texas)

# DEEP OUTFALL LINE TO PROTECT BAY WATERS.

City Engineer's Office, San Mateo, Calif. R. G. Bezzant. Public Works, Vol 101, No 3, p 102-103.

Descriptors: \*Sewer, \*Outlets, Deep water, Waste water treatment, Primary treatment, Effluents, Model studies, Tidal action, Finances, California. Identifiers: San Francisco Bay, San Mateo (Calif).

Sewerage improvements recently undertaken by the City of San Mateo include the construction of a deep water outfall to protect San Francisco Bay. The primary treatment plant serves a population of 90,000. The effluent from this plant will be discharged through this new 54 inch diameter outfall into the deep water ship channel some 3,700 feet from shore. The details of construction are provided and the mechanics of bedding and securing the line are included. Based on model studies of the Bay using a Corps of Engineer model, it is estimated that effluent injected into the bay at the location of the outfall will piston up and down the shipping channel for ten tidal cycles before it spreads enough to reach the shore. The cost of the project was \$2,453,700, and of this amount 33% was financed by the FWPCA under PL 660. (Goessling-Texas)

#### FUNGI IN SLUDGE DIGESTERS,

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Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
W. B. Cooke,

Proceedings, Industrial Waste Conference, 20th, May 4, 5, and 6, 1965, p 6-17, 8 fig, 17 ref.

Descriptors: \*Sludge digestion, \*Fungi, \*Anaerobic conditions, \*Waste water treatment, Molds, Yeasts, Spores, Sewage, Activated sludge, Trickling filters.

Numerous investigators have reported that fairly large numbers of filamentous fungus and yeasts occur in sewage, sewage polluted water and sewage treatment systems. Others state that if fungus spores are present in sludges, they are inactive because they require oxygen for metabolic processes. Two continuous laboratory sludge digesters with a retention time of 16 days were operated to determine if fungi were active under such conditions. The results of these experiments are: (1) fungi, including yeasts and molds are present in the sludge digestion process; (2) their numbers and consistent appearance in tests indicate that they may be taking part in the digestion process; (3) following the development of a stable sludge digestion system, many yeasts and molds are present; (4) fungi, including yeasts and molds, are members of a population of miscellaneous microorganisms occurring in sludge digestion; and (5) the presence of large numbers of viable cells at the end

of more than seven turnovers, even though reduced from the initial population by a factor of 3,000, indicate that filamentous fungi can grow and multiply in an anaerobic digester. Whether they are an important factor in digestion has not been determined. (Goessling-Texas) W72-01510

# PLASTIC RELINING OF SMALL-DIAMETER

Toronto Dept. of Public Works (Ontario). Raymond M. Bremner.

Journal of the Sanitary Engineering Division, Proceedings of ASCE, Vol 96, No. SA 2, April 1970, p 297-317. 25 fig, 3 tab.

Descriptors: \*Plastic pipes, \*Linings, \*Sewerage, Storm drains, Sewage disposal, Drainage systems, Operation and maintenance, Plastics, Pollution abatement.

abatement.
Identifiers: \*Sewer relining, \*Waste collection,
\*Hydraulic capacity, Toronto, Canada.

To assist the nationwide pollution abatement campaign in Canada, the City of Toronto will spend \$154,000,000 over 25 years for the construction of new storm sewers, adding an additional 400 miles of 9 in. to 30 in. diameter pipe to the 728 miles of 9 in to 30 in. diameter pipe to the 728 miles of 9 in to 30 in. diameter pipe currently in use. An estimated 1% or 38,500 ft of the pipe in this size range will need reconstruction annually. To prevent high reconstruction costs from interfering with new construction programs, a method of relining old pipe with a high density polyethylene liner was developed. Relining of 1,600 ft. of a 12 in. diameter sewer line was accomplished at an estimated 30% savings over current reconstruction costs by open-cut. Although the equipment has not been modified to line pipe of diameters larger than 12 in., savings to be realized by relining these larger sizes were estimated to be in excess of 30%, or an estimated yearly savings of \$500,000 on the 38,500 ft of small diameter pipe needing reconstruction annually. Relining also improved hydraulic capacity, making it ideally suitable for providing low-cost increased capacity for areas undergoing intensive development. (Lowry-Texas)

#### THE ROLE OF NITRATE NITROGEN IN BIO-OXIDATION, California Univ., Davis. Dept. of Civil Engineering.

California Univ., Davis. Dept. of Civil Engineering. E. D. Schroeder, and A. W. Busch. Proceedings, Industrial Waste Conference, 22nd, May 2, 3, and 4, 1967, p263-278. 10 fig, 41 ref.

Descriptors: \*Waste water treatment, \*Nitrates, Bacteria, Reduction, Oxidation, Aerobic conditions, Anaerobic conditions, Metabolism, Laboratory tests.

Identifiers: Assimilatory, Dissimilatory, \*Bio-oxidation.

Bacterial reduction of nitrate has been a subject of importance to engineers since the early part of the century. The results of nitrate additions to wastewater treatment processes have been unpredictable and generally less than expected. A study has been undertaken to more fully explain the role of nitrates in bio-oxidation. A series of experiments were conducted using three basic environments, aerobic, anaerobic with nitrate, and anaerobic without nitrate. Bacteria cultures used as innocula were of two types, oxygen acclimated and nitrate acclimated. Glucose was the basic substrate in all experiments. The results of these studies are: (1) terminal oxidation of glycolysis products occurred at a lower rate than glycolysis in the anaerobic systems using nitrate as a terminal hydrogen acceptor; (2) carbon removal rates associated with dis-similatory nitrate reduction were significantly lower than those associated with aerobic systems; (3) the acclimation procedures did not affect dis-similatory nitrate reduction, but did increase the ability of the cultures to metabolize excreted metabolic intermediates; (4) the concept of nitrate and other oxygen containing compounds acting as

sources of chemical oxygen has no validity mechanistically; and (5) the previous conclusions, particularly the rate differences, should be considered by those workers proposing aerobic denitrification. (Goessling-Texas) W72-01512

# THE CHEMICAL INDUSTRY AND POLLUTION CONTROL.

National Industrial Pollution Control Council, Washington, D.C.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, Price \$0.30. National Industrial Pollution Control Council, Sub-Council Report, June 1971, COM-71-50253, 25 p, 6 ref.

Descriptors: \*Industrial wastes, \*Chemical wastes, Air pollution, Solid wastes, Sludge, Biodegradation, Incineration, Water reuse, By-products, Odors, Activated carbon, \*Waste water treatment, Water pollution control.

Estimates of the number of synthetic compounds manufactured yearly by the chemical and allised products industries range from 500,000 to 600,000 with a multitude of new products being introduced each year. The chemical industries are: (1) 5th in assets and 6th in sales among manufacturers; (2) employ more than one million persons-10,000 in environmental research and pollution control facility operation; (3) 2nd among manufacturers in company financed research; (4) have invested 3.44 billion for new plants and equipment in 1970-5300 million for pollution abatement equipment and an additional 5300 million for operation. Both air and water pollution abatement programs are of major concern, as well as solid waste disposal techniques. However, the major emphasis is now being placed on a closed cycle scheme, with recovery and re-use becoming much more prominent. Industry achievements in research and development include: (1) biodegradation of organics in highly saline waste streams; (2) SO2 removal from power plant stack gases; (3) recovery of hydrochloric acid from chlorinated organic compounds; (4) improved air and water quality monitors; (5) significant reductions in mercury and other heavy metal discharges; and many others. (Lowry-Texas)

# THE USE AND DISPOSAL OF ELECTRICAL INSULATING LIQUIDS.

National Industrial Pollution Control Council, Washington, D.C.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, Price \$0.25. National Industrial Pollution Control Council, Sub-Council Report, June 1971, COM-71-50247. 22 p, 8 tab, 14 ref.

Descriptors: \*Electric insulation, Circuit breakers, Capacitors, \*Liquid wastes, Solid wastes, Biodegradation, Incineration, \*Waste water treatment, \*Industrial wastes, Waste disposai. Identifiers: \*Electrical insulating liquids, \*Chlorinated biphenyls, \*Mineral oils.

Although a wide variety of substances is used as electrical insulating liquids (EIL), the three most important are: (1) Napthenic mineral oils - 80.%; (2) Polybutenes - 10%; and (3) Askarels or polychlorinated biphenyls - 6.1%. Total usage of all liquids for 1968 was 62 million gallons. The first two major liquids are both relatively non-toxic and biodegradable. They may be either subjected to conventional secondary treatment, or information pertaining to reclaiming or proper disposal may be obtained from the manufacturers. In addition, total usage of petroleum based products is less than 10% by volume of the amount of waste-oils disposed to land yearly. Although still a problem, these factors have indicated a low priority should be assigned. Askarels, however, have some toxic properties and contain members which have become ecologically

# Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

#### **Group 5D—Waste Treatment Processes**

suspect recently, particularly those with more than 50% chlorination. Certain of these compounds are believed to act much like the persistent pesticides. They are being used sparingly for closed-circuit applications while work is continuing in efforts to develop a biodegradable modified chlorinated biphenyl (Lowry-Texas) W72-01514

HIGH-TEMPERATURE TREATMENT OF SEWAGE SLUDGES.

Water Pollution Research Lab., Stevenage (England). W. J. Fisher, and J. D. Swanwick.

Water Pollution Control, Vol 70, No 3, 1971, p 355-373, 10 fig, 19 tab, 10 ref.

Descriptors: \*Sludge treatment, \*Heat treatment, Chemical oxygen demand, Biochemical oxygen demand, Laboratory tests, Autoclaves, Suspended load. \*Waste water treatment.

Identifiers: \*Wet-air oxidation, Filtrability, Liquor strength.

Until recently, heat-treatment of sewage sludge had been limited to a few works treating difficult sludges by batch processing. The development of a continuous plant has stimulated interest in the process and today about thirty plants have been or are about to be built in the United Kingdom. Laboratory tests have been made on heat treating 12 different sludges and also on the partial (about 15%) wet air oxidation of these same sludges at 170,200 and 230 deg C. The results of these tests are: (1) all 12 sludges could be made readily filtrable by heat treatment or partial wet air oxidation;
(2) the suspended solids contents of all sludges, particularly secondary sludges, decreased on treat-ment; (3) a corollary to this is that the liquors from the secondary sludges were the strongest; (4) sludge type and sludge strength were the most important factors in determining liquor strength; (5) wet oxidation was more effective in reducing amount and COD of suspended solids; and (6) in general, there seemed to be little difference between the effect of heat treatment and wet air oxidation on the most important characteristics, namely filtrability of sludge and strength and treatability of liquor. (Goessling-Texas) W72-01515

A DISCUSSION OF 'INCINEROLOGY' WITH REFERENCE TO DEPOSITION CONTROL AND DEODORIZATION TECHNIQUES,

Combustion Engineering, Inc., Greenwich, Conn. R. D. Nickerson.

Preprint, presented at Water Pollution Control Federation Conference, 44th, Session 11, No 3,

October 5, 1971. 7 p, 3 fig, 4 ref.

Descriptors: \*Sludge disposal, \*Odors, \*Incinera-tion, Temperature, Oxidation, Oil, Viscosity, Waste water treatment, Maryland, Connecticut. Identifiers: Grease, So (Conn), \*Baltimore (Md). \*Waterbury Scrubbers,

Deodorization process schemes at Waterbury, Conn., and Baltimore, Maryland were examined along with several other treatment schemes. Operating experience at several varied locations has aided in the development of many diverse odor treatment mechanisms. The fundamental principles underlying nearly all of the processes were demonstrated to be: odorous component of the gas is subject to oxidation by the proper use of temperature, time, mixing, and excess air. Use of odorous gases as air supply to high temperature boilers was the most prevalent deodorization method. Deposition so studied and the proper use of h determined to be a low-cost effective, and simple means of control. (Lowry-Texas) W72-01516

WASTES FROM THE POULTRY INDUSTRY, National Agricultural Advisory Service, Guildford (England). C. T. Riley.

Agriculture, Vol 75, No 8, p 374-376, Aug 1968.

Descriptors: \*Poultry, Reclamation, Waste disposal, Nitrogen, Fertilizer, Protein, Moisture. Identifiers: \*Refeeding wastes, Cage layers, Broilers, Deep litter, Recycling.

Some waste materials normally produced by the poultry industry are defined and their relative importance is indicated. The increasing volume of wastes produced and the economics of utilizing these poultry wastes are discussed. (Dorland-Iowa W72-01553

BIOLOGICAL CONVERSION OF ANIMAL WASTES TO NUTRIENTS,
Colorado State Univ., Fort Collins. Dept. of Avian

Final report, May 1971. 69 p, 9 fig, 10 tab, 36 ref, append. Project no. HGW-PHS Solid Wastes Research Grant EC-00262-02.

Descriptors: \*Farm wastes, \*Lagoons, \*Chemical analysis, Crop response, Anaerobic bacteria, Odor, Amino acid, Poultry, Cattle, Larvae, Incubation, Organic matter, Soil structure, Economics,

Identifiers: \*Feed analysis, Automated manure handling, Caged laying, Crop yield, Plant nutrients.

Fly eggs were placed in fresh poultry manure under different temperature (22 to 38C) and relative humidity (19 to 80%) conditions to determine the hatchability of fly eggs, growth of larvae, produc-tion of pupae and physical changes in the poultry manure. Moisture loss from the manure was recorded daily. The inoculation rates varied from 2 g. to 5 g. fly eggs per 4000 g. of fresh poultry manure. Fly eggs and larvae were also placed under caged laying hens for the catabolism of the manure caged laying nens for the catabolism of the manutes as it was voided. Optimum yield of dry pupae was obtained with a combination of 3 g. fly eggs in 4000 g. of fresh poultry manure at 27C and relative humidity of 41%. Moisture in the manure was reduced from 78.5 to 55.0%. When relative humidity of the state of the s midity was increased from 38 to 70% the vield of pupae at 34 to 38C was significantly (PA0.01) increased. The combination of 2 g. eggs per 4000 g. of fresh manure produced significantly (PA0.01) heavier larvae. Hatchability of fly eggs in fresh poultry manure varied from 50.5 to 87.0%. In comparison to fresh poultry manure, the manure residue had less odor, contained less moisture and was granular in texture. The fly larvae developed under the caged layers, reducing freshly voided manure to granular material within a few hours. (Bundy-Iowa State) W72-01554

REDUCTION OF SALMONELLA IN COMPOST IN A HOG-FATTENING FARM OXIDATION VAT.

E. H. Kampelmacher, and L. M. Jansen. Journal Water Pollution Control Federation, Vol 43, No 7, July 1971, p 1541-1545. 4 fig, 3 tab, 3

Descriptors: \*Farm wastes, \*Oxidation ponds, Fertilizer, Swine, Aerobic, Aeration, Bacteria, Effluent, \*Salmonella, Samples, Confinement pens, Waste water treatment.

Identifiers: Oxidation vats, Bacteria count, Hog-fattening farm, Aerobic flora.

In recent years the number of large hog-fattening farms, where frequently thousands of animals are fattened, has increased greatly. On these farms, the disposal of urine and feces, which in such large quantities can no longer be used for fertilization, constitutes a serious problem. In order to deal with it by means of purification, oxidation vats have been constructed and oxidation ditches dug on these farms. A description is given of experiments carried out with a small experimental oxidation vat suitable for 160 hogs and installed on a hog-fattening farm in Wageningen by the Institute Landbouw

en Bedrijfsgebouwen. The study was performed to determine whether bacteriological reduction in general and elimination of Salmonella in particular occur. The reduction of Salmonella in composts in an experimental oxidation vat on a hog-fattening farm was shown to be approximately 100-fold. As long as the excretion of Salmonella in the feces of the hogs remain low, only small numbers of Sal-monella bacteria will be sluiced out with the effluent, thus, the possibility of human and/or animal infection in surface water may be regarded as very slight. As soon as either the number of hogs or the number of excreted bacteria, or both, increases, the plant can no longer adequately reduce the number of salmonellae to the extent that the effluent can be sluiced out into open water without the danger of human or animal infection. Therefore, it is recommended that adequate chlorination of the effluent of such plants be considered. (Bundy-Iowa State) W72-01560

TECHNICAL AND INSTITUTIONAL ASPECTS OF SEWAGE EFFLUENT-IRRIGATION WATER EXCHANGE, TUCSON REGION, Arizona Univ., Tucson.

For primary bibliographic entry see Field 06E.

W72-01569

# 5E. Ultimate Disposal of Wastes

CONCEPTS IN OPEN COASTAL DISPOSAL OF MUNICIPAL WASTEWATERS.

California State Water Resources Control Board. For primary bibliographic entry see Field 05D. W72-01504

LIQUID DIGESTED SEWAGE SLUDGE GIVES FIELD CROPS NECESSARY NUTRIENTS, O. C. Braids, M. Sobhan-Ardakani, and J. A. E.

Molina. Illinois Research, Vol 12, No 3, Summer 1970, p 6-

Descriptors: Sludge, Sludge disposal, \*Sewage sludge, \*Nutrients, Nitrates, Analysis, \*Field crops, Crop production, Soil analysis, Leaching, Corn, Sorghum, Lysimeters.

Identifiers: Digested sludge, Heavy metals, Reed canary grass, Drain water.

Irrigation of cropland with digested sludge is seen as a way of recycling the elements and reducing ultimate disposal costs. To learn more about this subject, a study utilizing an existing lysimeter facility was conducted. A digested sludge having a solids content of 2 to 4 percent by weight was obtained from a sewage treatment plant. A 1-inch application of sludge on an acre contains about 330 pounds of nitrogen, 180 pounds of phosphorus and 40 pounds of potassium. Corn, Reed canary grass, and grain sorghums were grown with two levels of e irrigation; 10 inches in 1968 and 7 inches in 1969. This level, without exception, produced yields as good as, or better than, those obtained with water irrigation and relatively high levels of commercial fertilizer. In this test crop and leaf analysis were made as well as soil analysis. The drain water was also analyzed. One problem noted was the increased concentration of nitrate-nitrogen found in the water from the sludge-treated plots. The nitrogen content of digested sludge appears to be the first limiting factor to loading rate. (Parker-W72-01556

LEGISLATION TO END INDISCRIMINATE OCEAN DUMPING, For primary bibliographic entry see Field 06E.

W72-01682

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# WATER QUALITY MANAGEMENT AND PROTECTION-Field 05

# Water Quality Control—Group 5G

# 5F. Water Treatment and **Quality Alteration**

THE HYGIENIC EVALUATION OF GOOD CROPS GROWN IN SOIL IRRIGATED WITH INDUSTRIAL WASTE WATER, (IN RUSSIAN), Kiev Inst. of Nutritional Hygiene (USSR). For primary bibliographic entry see Field 03F. W72-01243

STATISTICAL CORRELATIONS BETWEEN TOTAL COLIFORM AND ENTEROCOCCUS COUNTS IN WATER SUPPLY OF TARAI RE-

GION, Uttar Pradesh Agricultural Univ., Naini Tal (India). Coll. of Veterinary Medicine. For primary bibliographic entry see Field 05A. W72-01248

DRINKING WATER QUALITY STANDARDS NEEDED

House of Representatives, Washington, D.C. For primary bibliographic entry see Field 06E. W72-01345

VIRUSES IN WATER.

Poliomyelitis Research Foundation, Johannesburg (South Africa). H Malherhe.

South African Journal of Science, Vol. 67, No. 3, p. 124-127, March 1971. 2 tab, 1 ref.

Descriptors: Water pollution sources, \*Sewage treatment, \*Viruses, \*Public health, Epidemiology, Arid lands, Viricides, Laboratory tests, On-site data collections, Aquatic microorganisms. Identifiers: \*South Africa.

True viruses, unlike bacteria, cannot multiply in water alone, but must have a cellular host. Neverless, the survival time in water of many viruses ensures that this medium may facilitate their spread to human hosts. Viral detection is not simple and requires extensive laboratory facilities. While hu-mans are hosts for a large number of viruses, detection is simplified by the assumption that if any of a relatively small group of common viruses are present, one may conclude that others may be present under similar conditions. Pioneer investigations are described in which viral survival in sewage treated by conventional methods at 2 Johannesburg purification plants were assayed. There is a peak period of daily community viral content related to fecal excretion just before and after breakfast. Reoviruses and enteroviruses were assayed at each stage of treatment, and it was determined that the viruses passed through each stage virtually unimpeded. The effluents from both plants were treated in shallow maturation ponds for periods long enough for viral inactivation. Arid areas present special problems because often sewage must be rapidly treated because of water scarcity. The problems of treating water containing the inefective hepatitis virus are also discussed. (Casey-Arizona) W72-01470

U. S. ARMY TEST AND EVALUATION COM-MAND COMMODITY ENGINEERING TESTS PROCEDURE WATER SUPPLY AND TREATMENT EQUIPMENT.

Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

For primary bibliographic entry see Field 05D. W72-01496

A STUDY OF SOME DISEASE HAZARDS WHICH COULD BE ASSOCIATED WITH THE OF APPLYING CATTLE SLURRY PASTURE,

Agricultural Research Council, Compton (England). Inst. for Research on Animal Diseases.

For primary bibliographic entry see Field 05A. W72-01559

# 5G. Water Quality Control

TOUGHER ENFORCEMENT OF POLLUTION CONTROLS,
For primary bibliographic entry see Field 06E.
W71-02670

#### CLEAN WATER FOR GEORGIA'S ESTUARIES.

Summary, Georgia Public Meeting, National Estuarine Pollution Study, February 29, 1968. Federal Water Pollution Control Administration, Atlanta, Georgia, 10 p, 8 photo.

Descriptors: \*Georgia, \*Estuaries, \*Project planning, \*Water pollution control, Water resources development, Environmental sanitation, Water users, Feasibility studies, Governmental finance, Grants, Sewage treatment, Secondary treatment, Waste disposal, Treatment facilities, Water quality control, Standards, Pollution abate-ment, Recreation, Industries, Land use, Fishing. Identifiers: \*Federal Water Pollution Control Administration.

The Clean Water Restoration Act of 1966 authorized a national estuarine pollution study by the Federal Water Pollution Control Administration. Estuarine water users' views concerning the problems of water pollution control were considered at public meetings in Georgia. These statements are summarized in five categories: research, planning, industry, commercial fishing, and recreation. Research groups advocated the establishment of large estuarine parks along the Atlantic and Gulf coasts in which feasibility studies could be con-ducted. Emphasis should be on improving waste treatment processes and upgrading water quality control procedures. Long-range project planning is recommended to insure optimum use of estuarine water resources. It is further recommended that certain areas be left in a natural state to preserve wildlife habitats. Industrial estuarine users and polluters recognized the need for extensive rese and supported the efforts of the Georgia Water Qualtiy Control Board. Industrial spokesmen questioned the advisability of estensive federal participation in estuarine management. Commerical fishermen deplored the effects that improper waste treatment had upon the marine ecology. Recreation interests stressed the fact that unchecked water pollution endangered tourism. (Rees-Florida) W72-01056

#### CLEAN WATER FOR VIRGIN ISLANDS' ESTUARIES.

Summary, Virgin Islands Public Meeting, National Estuarine Pollution Study, April 17, 1968. Christiansted, St. Croix, Federal Water Pollution Control Administration, Atlanta, Georgia, 10 p, 6

Descriptors: \*Virgin Islands, \*Water pollution control, \*Estuaries, \*Estuarine environment, Water policy, Water resources, Water pollution, Water poncy, Water quality, water pointon, Water quality, Water quality control, Recreation, Indus-tries, Planning, Navigation, Environmental sanita-tion, Coasts, Water law, Legal aspects. Identifiers: \*Clean Water Restoration Act.

The Clean Water Restoration Act of 1966 authorized the National Estuarine Pollution Study by the Department of the Interior. Meetings were held in the Virgin Islands to obtain views and opinions of public and private groups, individuals, federal agencies, and territorial agencies having an interest in the coastal waters of the Virgin Islands. A panel of experts was gathered to elicit additional information and views important to the study. Statements presented by various interests are sum marized in the following six categories: (1) responsibility, (2) planning, (3) industry, (4) recreation, (5) research, and (6) navigation. (Robinson-W72-01057

CLEAN WATER ACT NEEDS CHANGES. House of Representatives, Washington, D.C. For primary bibliographic entry see Field 06E. W72-01121

INTRODUCTION OF THE NATIONAL WATER QUALITY STANDARDS ACT OF 1971, Senate, Washington, D.C.
For primary bibliographic entry see Field 06E.
W72-01215

FASCELL INTRODUCES LEGISLATION TO CONTROL OCEAN DUMPING,
House of Representatives, Washington, D.C.
For primary bibliographic entry see Field 06E. W72-01216

INTRODUCTION OF A BILL TO ESTABLISH AN IMMEDIATE PROGRAM FOR THE PREVENTION OF OCEAN POLLUTION, Senate, Washington, D.C.
For primary bibliographic entry see Field 06E.
W72-01218

MONROE COUNTY CONSERVATION ASS'N V. HANSEN (DENIAL OF MOTION FOR TEMPO-RARY INJUNCTION TO PREVENT DUMPING DREDGE SPOILS INTO LAKE ONTARIO). For primary bibliographic entry see Field 06E. W72-01229

CASCO V. GOTBAUM (MUNICIPAL TREAT-MENT FACILITY WORK STOPPAGE EN-JOINED AS MALICIOUS POLLUTION OF THE ENVIRONMENT). For primary bibliographic entry see Field 06E. W72-01231

UNITED STATES V. UNITED STATES STEEL CO. (VALIDITY OF INFORMATION CHARGING VIOLATION OF REFUSE ACT). For primary bibliographic entry see Field 06E. W72-01235

UNITED STATES V MAPLEWOOD POULTRY CO. (APPLICABILITY OF RIVERS AND HARBORS ACT TO WASTE DISCHARGES NOT IMPAIRING NAVIGATION). For primary bibliographic entry see Field 06E. W72-01236

FREEMAN V. CONTRA COSTA COUNTY WATER DISTRICT (PREVENTION OF CON-TAMINATION OF PUBLIC WATER SUPPLY FROM AUXILIARY WATER SUPPLY BACK-

For primary bibliographic entry see Field 06E. W72-01244

COLGATE-PALMOLIVE CO. V. HOSKINSON (CONSENT JUDGMENT REGARDING THE EN. FORCEMENT OF AN ORDINANCE REGULAT-ING THE SALE OF DETERGENTS CONTAIN-ING PHOSPHORUS).

For primary bibliographic entry see Field 06E. W72-01247

PEOPLE EX REL COUNTY OF DU PAGE V SMITH (CONSITUTIONALITY OF A SEWAGE AND POLLUTION CONTROL ACT). For primary bibliographic entry see Field 06E. W72-01249

# Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

#### Group 5G-Water Quality Control

V. NELSON (INSUFFICIENT NEWMAN EVIDENCE TO PROVE PUNITIVE DAMAGES FOR POLLUTION OF POND BY CRUDE OIL FROM STORAGE TANK SEEPAGE). For primary bibliographic entry see Field 06E. W72-01251

STUDIES ON WATER MOVEMENT AND DISPERSION OF MOSQUITO LARVAE, WITH SPECIAL REFERENCE TO CONTROL IN RICE

Microbiological Research Establishment, Salisbury (England).

Bull Entomol Res. 60 (2): 275-283. Illus. 1970. Identifiers: Aedes-Aegypti, Anopheles-Stephensi, Chemical, Control, Dispersion, Fields, Irrigation, Larvae, Mosquito, Movement, Respiration, Rice-

The effect of water current on the dispersion of the larvae of Aedes aegypti (L.) and Anopheles stephensi List. were examined in the laboratory. The larvae represent 2 distinct respiratory positions, and on3he basis of their movement were termed active and inactive, respectively. While ac-tive larvae resist water currents, and tend to disperse evenly in a field system, inactive larvae tend to be washed away and accumulate in loci of minimal water movement. These findings could be applied to detection of larval populations, control by irrigation and spot chemical treatments in rice fields.—Copyright 1971, Biological Abstracts, Inc. W72-01255

NIXON TRIES TO FOLLOW MUSKIE'S

For primary bibliographic entry see Field 06E. W72-01261

EFFECT OF SELENIUM ON GROWTH AND DEVELOPMENT OF MICROCYSTIS AERU-GINOSA KUTZ,

D. A. V. Coll., Kanpur (India).

S. N. Pandey. Labdev J Sci Technol Part B. 8 (4): 217-218. 1970. Identifiers: Development, Growth, Inhibitor, Labdev J Sci Tecnnor, Growth, Identifiers: Development, Growth, Selenium, Sodium

Se as sodium selenate which shows toxic effects at low concentration (1 ppm) may be used to control the growth of toxic algae, like M. aeruginosa..-Copyright 1971, Biological Abstracts, Inc. W72-01263

CONTROL OF CHIRONOMID MIDGES IN RECREATIONAL LAKES,

California Univ., Riverside. Dept. of Entomology. Mir S. Mulla, R. Lee Norland, Dean M. Fanara, Husam A. Darwazeh, and Donald W. McKean.

J Econ Entomol. 64 (1): 300-307. 1971. Identifiers: Abate, Bass, Bluegill, Carbaryl, Chironomid, Chironomus-Spp, Control, Dursban, Fenthion, Fish, Gambusia-Affinis, Insecticides, Largemouth, Lepomis-Macrochirus, Micropterus-Salmoides, Midges, Mosquito, Proclaideus-Spp, Pomoxis-Nigromaculatus, Recreational, Tanytarsus-Spp, Toxicity

Several commonly available and experimental insecticides were evaluated for control of chironomid midge larvae, Chironomus spp., Proclaideus spp., and Tanytarsus spp. in 2 recreational lakes. In Lake Calabasas, where the bottom has a thin layer of mud on a surface of cement, standard midge larvicides such as Abate (O, O-dimethyl phosphorothioate O,O-diester with 4,4'thiodiphenol) and fenthion proved highly effective. Fenthion at 0.5 lb per surface acre controlled the larvae for more than 7 wk. At this rate of application very slight mortality of the mosquito fish Gam-busia affinis (Baird and Girard) was observed. Abate at 0.75 pounds per acre controlled the midges for about 4-5 wk and causes slight mortality of the fish. Dursban (O,O-diethyl O- (3,5,6-

trichloro-2-pyridyl) phosphorothioate) at the rate of 0.2 lb/acre yielded long-lasting control of midge larvae, the suppression lasting for almost 5 mo. In Westlake (about 10 mi from Lake Calabasas), with Westlake (about 10 mi from Lake Calabasas), with a natural bottom, where small portions were treated, fenthion at 0.5 lb/acre yielded little or no control of the midge larvae. Abate at 0.5 lb/acre produced similar results. Carbaryl at 0.5 and 1.0 lb/acre yielded good control, but its longevity was for only 2-3 wk. Dursban insecticide applied as granules or sprays at 0.2 lb/acre yielded excellent control of midge larvae. The granular formulations produced better and longer-lasting larval control than an emulsifiable concentrate formulation. The latter formulation at 0.2 lb/acre or higher rate caused slight kill of bluegill, Lepomis macrochirus Rafinesque; largemouth bass, Micropterus salmoides Lacepede; and black crappie, Pomoxis nigromaculatus (Le Sueur) in the lake. No mortality of fish was observed in plots treated with a ty of fish was observed in plots treated with a granular formulation of Dursban at the same rate.--Copyright 1971, Biological Abstracts, Inc. W72-01267

# CONSERVATION OF NATURAL RESOURCES,

Guy-Harold Smith. Wiley, New York, 1971. 4th Edition. Identifiers: Conservation, Natural, Resources,

This book offers a collection of 25 papers on the problems and challenges of environmental pollu-tion for the student, scientist, professional conservationist, public servant or concerned citizen. An introductory part contains papers on the history of conservation in the USA, the history of the concept and application of the Public Domain and economic theory and conservation. Four selections follow, outlining the soil orders and suborders of the USA and their utilization, discussing soil and air conservation and the actual uses of land in the country. Part 3 covers water pollution, water supply for both domestic and industrial uses, irrigation and reclamation of wet and overflow lands, the utilization of waterways, flood control and the conutilization of waterways, nood control and the con-servation of water power. Conservation of mineral resources and the mineral fuels are considered next, followed by papers on grassland resources and concepts in forest management and the availa-ble forest resources. Part 6 deals with the conservation of wildlife and fishery resources; part 7 covers recreational resources and the conservation of man, including population controls and wastes and care for the disabled. The final 2 papers discuss city and regional planning and national planning in relation to the conservation of resources. A list ofgeneral works on conservation and an index con-clude the test.--Copyright 1971, Biological Abstracts, Inc. W72-01270

UNITED STATES V. TRANSIT-MIX CONCRETE CO. (INFORMER'S RIGHT TO ONE-HALF OF FINE UNDER REFUSE ACT), For primary bibliographic entry see Field 06E. W72-01277

RESERVE MINING CO. V MINNESOTA POL-LUTION CONTROL AGENCY (REQUEST FOR VARIANCE FROM POLLUTION CONTROL REGULATIONS).

For primary bibliographic entry see Field 06E. W72-01278

CONNECTICUT ACTION NOW, INC. V. ROBERTS PLATING CO. (ACTION TO ABATE WATER POLLUTION UNDER REFUSE ACT). For primary bibliographic entry see Field 06E. W72-01285

AIPLE TOWING CO. V. VOIGHT (NO TEMPORARY RESTRAINING ORDER ISSUED UNLESS PARTY SHOWED GOOD CHANCE OF ULTI-MATE SUCCESS).

For primary bibliographic entry see Field 06E. W72-01287

THE DELAWARE OYSTER INDUSTRY: A REALITY, Delaware Univ., Lewes. Marine Lab.

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Don Maurer, Les Watling, and Richard Keck. Trans Amer Fish Soc. 100 (1): 100-111. Map.

Identifiers: Delaware, Disease, Industry, Management, Minchinia-Nelsoni, Mortalities, Oyster.

Delaware oyster beds in the Bay and associated tributaries were studied from 1968 to 1970 to determine their general condition following mass mortalities from MSX (Minchinia nelsoni) during the late 1950's and 1960's. Estimates of standing crop of oysters yielded a total of 54,582 bushels covering 236.9 acres (95.9 ha) in the river beds and 65,482 bushels covering 941 acres (380.8 ha) in the bay beds. Bay beds were badly depleted whereas certain rivers showed potential as seed areas. The association of high oyster production with a hard shell substrate was demonstrated which emphasized the need for a regular shell planting program. Spat monitoring indicated that setting oc-curred in 2 waves and extended from July 4 to early in Sept. River mouths generally received the heavi-est set. Since there has been practically no oyster-ing in Delaware for 12 yr, an experimental planting of seed on 3 planted beds was carried out in 1969-1970. Although all the experimental beds were not productive, 1 bed showed promise and indicated productive, I bed showed promise and indicated that with proper management Delaware oyster beds can be rehabilitated. Finally, examination of histological sections for MSX suggested that the incidence of this disease was probably always lower in the river beds than the bay beds. The incidence of MSX in the bay beds was not as high as it was in of MSX in the bay beds was not as high as it was in the mid-1960's.--Copyright 1971, Biological Ab-W72-01294

ALAMEDA CONSERVATION ASS'N V. CALIFORNIA (STANDING TO SUE FOR ENVIRONMENTAL DEGRADATION). For primary bibliographic entry see Field 06E. W72-01297

TEXAS V. PANKEY (FEDERAL COURT JU-RISDICTION TO DECIDE QUESTION OF WATER POLLUTION FROM PESTICIDE RU-

For primary bibliographic entry see Field 06E. W72-01313

CONTINENTAL OIL CO. V WILLIAMS (RUNNING OF THE STATUTE OF LIMITATIONS IN DAMAGES CREATED BY ESCAPING

SALT WATER).
For primary bibliographic entry see Field 06E.
W72-01315

THE MARINE SANCTUARIES STUDY ACT OF THE MARINE SANCTUARIES STUDY ACT OF 1971 (A BILL TO AUTHORIZE THE SECRETARY OF THE INTERIOR TO STUDY THE MOST DESIRABLE MEANS OF ESTABLISHING CERTAIN PORTIONS OF THE TIDELANDS, OUTER CONTINENTAL SHELF, SEAWARD ARE AS, AND GREAT LAKES OF THE UNITED STATES AS MARINE SANCTUARIES).

For primary bibliographic entry see Field 06E. W72-01321

THERMODYNAMIC PROPERTIES OF BRINE, Oklahoma State Univ.. Stillwater, Dept. of Oklahoma State Univ., Stillwater. Dept. Mechanical Engineering.
For primary bibliographic entry see Field 01B.
W72-01341

ENVIRONMENTAL QUALITY: THE WET-LANDS OF THE CHESAPEAKE BAY MUST BE

Senate, Washington, D.C. For primary bibliographic entry see Field 06E. W72-01344

# WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Quality Control—Group 5G

DRINKING WATER QUALITY STANDARDS

NEEDED, House of Representatives, Washington, D.C. For primary bibliographic entry see Field 06E. W72-01345

ENVIRONMENTAL RESOURCE ALLOCA-

TION,
Purdue Univ., Lafayette, Ind.
T. A. Ferrar, and A. Whinston.
Project report, n.d. 41 p, 8 fig. OWRR B-020-IND

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WET-ST BE Descriptors: \*Resource allocation, \*Administrative agencies, Mathematical models, Air pollution, Water pollution, Total costs, Marginal costs, Bids,

Requilibrium prices.

Identifiers: \*Effluent charges, \*Property rights allocation, \*Environmental quality standards, \*Pollution control.

The technique of controlling pollution by effluent charges is examined and compared with the method of direct allocation of environmental property rights. What is being discussed is the operaperty rights. What is being discussed is the opera-tion of an environmental management organization (executive agency, sub-agencies and polluters) to maintain a specified level of environmental quality, the goal being to maximize some welfare criterion. The main objection to effluent charges is that as a static equilibrium tax scheme for the pricing of an economic good, they may never achieve environmental quality standards in the dynamic system of a developing urban center. The allocation method involves an incentive feedback algorithm that iteratively allocate the acceptance of the process of the proces voives an incentive feedback algorithm that iteratively allocates the environment's disposal capacity above the quality standards in accordance with the goal function. A bidding operation apportions these property rights among sub-agencies and then among polluters. The polluters provide the motive force to push the reapportionment process to op-timality (equilibrium) under a reasonable goal function. In a dynamic economic framework optimal allocation can be followed through time while environmental quality standards are preserved. Costs associated with disequilibrium allocation will be borne by the polluters and not by the environ-ment, as with the effluent charge technique. (Haugh-Wisconsin) W72-01349

SOLUTIONS TO POLLUTION: SOME GIVING AND TAKING, Clemson Univ., S.C. Dept. of Economics.

H. H. Macaulay.

Address at the Annual Meeting of the National Tax
Association, Honolulu, Hawaii, September 22,
1970. 19 ref. OWRR B-030-SC (1).

Descriptors: \*Economics, \*Taxes, \*Competing uses, \*Governments, \*Pricing, Legislation, Pollution abatement, Costs.

Identifiers: \*Environmental pollution, \*Subsidies, \*Effluent charges.

Environmental pollution is the economic problem of two or more parties seeking to use one of na-ture's gifts in ways that are incompatible. Precedent for treating the environment (a scarce asset) as an economic good and rationing its use by the price mechanism is defined in the earlier case of land, once a free commodity and now a scarcity. Subsidies, in the form of tax incentives, do not put the cost of pollution on those causing it or create interest in altering production techniques to eliminate waste. They are instead an incentive for firms to produce more waste to receive more subsidy. They also create taxation complications and problems in determining 'normal' waste levels. Past subsidies, in the form of state tax relief for the subsides, in the form of state tax relief for the purchase of pollution abatement equipment, attest to their failure in solving the pollution problem. The solution suggested is to charge those who pollute an amount equal to the marginal damage caused (effluent charges). This would discourage waste, increase economic welfare, and increase governmental revenues. Those who benefit from increased environmental quality about also be increased environmental quality should also be

charged, thereby increasing tax revenues and contributing to efficient resource allocation. (Haugh-Wisconsin) W72-01350

FEDERAL WATER POLLUTION CONTROL

ACT, House of Representatives, Washington, D.C. For primary bibliographic entry see Field 06E. W72-01354

A MACROSYSTEM ANALYSIS OF THE HUMAN ENVIRONMENT, Pittsburgh Univ., Pa.

For primary bibliographic entry see Field 06A. W72-01355

INTRODUCTION OF THE ENVIRONMENTAL

PROTECTION ACT OF 1970, Senate, Washington, D.C. For primary bibliographic entry see Field 06E. W72-01360

SECRETARY HICKEL'S NEW POLLUTION CONTROL RULES SHOULD GO MUCH

For primary bibliographic entry see Field 06E. W72-01364

NIGHTTIME ARTIFICIAL AERATION OF PUDDINGSTONE RESERVOIR, LOS ANGELES

COUNTY, CALIFORNIA,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife; and California State Dept. of Fish and Game, Long Beach. Arlo W. Fast, and James A. St Amant.

California Fish and Game, Vol 57, No 3, p 213-216, 1971. 1 fig, 3 ref.

Descriptors: \*Aeration, \*California, \*Reservoirs, \*Fisheries, Trout, Temperature, Oxygen, Mixing, Hypolimnion, Stratification, Dissolved oxygen, Heat budget, Oxygenation. Identifiers: \*Puddingstone Reservoir (Calif), \*Los Angeles County (Calif), Nighttime air injection.

Fish habitat and available food are increased and probability of oxygen depletion reduced by artifi-cial destratification of eutrophic reservoirs. While continuous artificial destratification eliminates the oxygen deficit it increases the heat budget so that the entire lake has about the same temperature as the surface water. Puddingstone Reservoir (Southern California) is a year long warmwater fishery, but a trout fishery only during the cooler months. It was artificially destratified during 1965 using a nighttime air injection schedule, which maintained suitable oxygen levels but increased minimum temperatures to intolerable levels for trout. Fast (1968) describes devices for aerating the hypolimnion without producing thermal destratification. Barnhardt (1967) discusses the artificial aeration of the hypolmnion of Wahnback Reservoir where oxygen values were increased from near zero to over 5.0 mg/l. Fast (unpublished data) was able to increase hypolimnion oxygen concentrations in a small Michigan lake from 0.0 mg/l to over 11.0 mg/l using a new aerator design. A system of hypolimnion aeration is recommended for use in Puddingstone Reservoir to produce both adequate oxygen and temperature for trout at all times of the year. (Jones-Wisconsin) W72-01368

EXOTIC USES OF AQUIFERS,

Louisiana State Univ., Baton Rouge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04B.
W72-01422

AIR. WATER AND SOIL POLLUTION. Colorado State Univ., Fort Collins.

Colorado State University Research, Vol. 2, No 1, Oct-Dec 1970. 1 page (unnumbered) 1 fig.

Descriptors: \*Air pollution, \*Air pollution effects, \*Water resources, \*Water pollution, \*Water pollu-tion effects, Impaired water quality, Optimization, Water management (Applied), Irrigation efficien-cy, Research and development, Administration, Education, Hydrologic cycle, Irrigation water, Water quality control, Management, Soil water, Mining, Colorado.

Colorado is using its air and water resources to maximum capacity. A water-management program for irrigation efficiency is discussed in terms of engineering, research, administration and education. Pollution effects of the hydrologic cycle are applied to the evaluation of irrigation water. Cooperative water-quality control projects are outlined. Management problems, irrigation and soil water, in-place-oil-shale mining, stream pollution and feedlot air pollution are discussed. (Popkin-Arizona) Arizona) W72-01446

GROWING PROBLEM OF OIL SPILLS-REASONS AND REMEDIES.

For primary bibliographic entry see Field 06E. W72-01477

POWERS OF COMMISSION, (RECREATION AND WATER POLLUTION CONTROL). For primary bibliographic entry see Field 06E. W72-01483

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER BASIN, VOL 6, SECTION H - THE NATURE OF MINIMUM COST SYSTEMS FOR WATER QUALITY MANAGEMENT ON THE WISCONSIN RIVER, Wisconsin Univ., Madison. Dept. of Industrial Engineering; and Wisconsin Univ., Madison. Dept. of Agricultural Economics.

Agricultural Economics. Charles H. Falkner, Gary G. Storey, Elizabeth L. David, John T. Quigley, and Alasdair MacCormick. Available from the National Technical Information Available from the National Technical Information Service as PB-204 579, \$3.00 in paper copy, \$0.95 in microfiche. Wisconsin Water Resources Center, Madison, 1970. 356 p, 67 fig, 88 tab, 81 ref. OWRR C-1228 (No 1601) (9).

Descriptors: "Water quality control, "Economic efficiency, "Standards, "Management, "Feasibility studies, Cost comparisons, Costs, Aeration, Flow augmentation, Mathematical models, Forecasting, Water pollution control, Dissolved oxygen, Flow, Rivers, Waste treatment, Constraints, Decision making, Model studies, Risks, ethodology, Wisconsin

Identifiers: \*Wisconsin River (Wis), Waste discharges, A priori policies, Redistribution of waste sources.

This volume presents the results of six studies to analyze the variations in waste reduction require-ments along a 180-mile reach of the Wisconsin River. The variation of waste reduction requirements is studied as a function of specified minimum concentrations of dissolved oxygen, levels of waste discharge by various sources, the designation of various uses for specified sub-reaches of the river, the risk that dissolved oxygen standard will be contravened, a priori policies such as primary treatment plus chlorination or secondary treatment for all municipalities, prior process changes for several industrial sources, turbine and mechanical aeration, and plans for redistribution of waste discharge points. The trade-offs between flow augmentation, waste reduction, recreation, and power are examined. It is concluded that a minimum cost waste ammen. It is Concluded that a minimum cost waste reduction plan depends critically on the assumed bases, and thus it is necessary for the water quality management agency to carefully analyze the effect of these assumptions. (Falkner-Wisconsin) W72-01486

# Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

# Group 5G-Water Quality Control

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER BASIN, VOL 3, SEC-TION D - THE DEVELOPMENT OF PREDIC-TIVE WATER QUALITY MODELS.

Wisconsin Univ., Madison. Dept. of Industrial En-

Charles H. Falkner, V. R. Kapoor, C. E.

McQuilian, A. G. Marten, and S. S. Sethi. Available from the National Technical Information Available 110m the Stational Technical Information Service as PB-204 578, \$3.00 in paper copy, \$0.95 in microfiche. Wisconsin Water Resources Center Madison, 1971. 481 p, 101 fig, 40 tab, 171 ref, 2 append. OWRR C-1228 (No 1601) (10).

Descriptors: \*Water quality control, \*Mathematical models, \*Methodology, \*Model studies, Rivers, Linear programming, Dissolved oxygen, Biochemi-Linear programming, Dissolved oxygen, Blochemical oxygen demand, Regression analysis, Flow, Temperature, Costs, Wastes, Cost sharing, Computer programs, Waste water (Pollution), Probability, Stochastic processes.

Identifiers: \*Water quality management. \*Wiscon-

sin River (Wis), Sensitivity analysis, Temperature prediction model, Waste discharges reduction.

This volume presents two mathematical models for use in water quality management and examines their application. A simulation model for predicting dissolved oxygen over a long reach of river based upon the Streeter-Phelps differential equations is described and examined as to its sensitivity to river depth and deoxygenation rate coefficient. Procedures for validating the simulation model are proposed. Additionally, a regression model for predicting water temperature as input to the simulation model is delineated. For given flow and temperature profiles on this long reach of the Wisconsin River the simulation model calculates coefficients which attribute oxygen delicit to individual waste sources. Given state standards for minimum dissolved oxygen these deficit coefficients form a matrix defining constraints for the allowable amounts of waste discharged. A survey of stochastic programming techniques revealed that the problem of determining allowable waste discharges did not fit into existing techniques. A solution procedure for this semi-linear programming problem in which the objective function is a separable step function is presented; this solution procedure is implemented by interactive computing involving the problem solver. Use of these mathematical models in water quality management is discussed with special reference to their part in control systems and for calculating cost sharing plans. (Falkner-Wisconsin) W72-01487

METHODOLOGY FOR SYNTHESIS AND OP-TIMIZATION OF DIFFUSION PATTERNS IN FLOW SYSTEMS,

Illinoise Univ., Urbana. Dept. of Civil Engineering. For primary bibliographic entry see Field 08B. W72-01490

KNIGHT V. WEST ALABAMA ENVIRONMEN-TAL IMPROVEMENT AUTHORITY (CON-STITUTIONALITY OF ENVIRONMENTAL IM-

PROVEMENT ACT).
For primary bibliographic entry see Field 06E.
W72-01497

UNITED STATES V. ST. REGIS PAPER CO. (RECOVERY OF INFORMER'S ONE-HALF OF FINE PAID BY CONVICTED WATER POL-LUTER UNDER REFUSE ACT OF 1899). For primary bibliographic entry see Field 06E. W72-01503

THE CHEMICAL INDUSTRY AND POLLUTION CONTROL.

National Industrial Pollution Control Council, Washington, D.C.

For primary bibliographic entry see Field 05D. W72-01513

THE EFFECTS OF PESTICIDES ON WATER RESOURCE DEVELOPMENTS.

For primary bibliographic entry see Field 05C. W72-01517

OF PESTICIDES IN WATER RESOURCE DEVELOPMENTS,

Agricultural Research Service, Washington, D.C. For primary bibliographic entry see Field 05C. W72-01519

STUDY AND UTILIZATION OF THE WATER RESOURCES OF THE USSR, 1966-1967, (IZUCHENIYE I ISPOL'ZOVANIYE VODNYKH RESURSOV SSSR, 1966-1967 GG). Akademiya Nauk SSSR, Moscow. Inst. of Water

For primary bibliographic entry see Field 02A. W72-01549

PLANT NUTRIENTS AND WATER QUALITY, C. R. Frink

Agricultural Science Review, Vol 9, No 2, Second Quarter 1971, p 11-25. 4 tab, 3 fig, 34 ref.

Descriptors: \*Cycling nutrients, Water quality con trol, Fertilizers, \*Nutrients, Watersheds (Basins), \*Farm wastes, Surface runoff, Subsurface runoff, Systems analysis, Farm wastes, Nitrogen, Nitrates, Agricultural chemicals, Fertilizers, Phosphorus, Water pollution sources ater pollution sources.

Identifiers: \*Plant nutrients, Political units, Farming systems.

Nutrient yields to waterways were examined in three ways: direct measurements in watersheds, analysis of farming systems, and calculations for political subdivisions. Direct measurements in watersheds have shown, for example, that agricul-tural runoff supplied significant quantities of nitrogen in the Potomac River Basin but was not an important source of phosphorus. Farming systems analysis was proposed to avoid the cost of a national water monitoring network. Such things as various methods of fertilizer application were con-sidered. And the possibility of sewage effluent to a soil-crop filter rather than dilution in streams. The calculations of nutrient sources for political units should help us establish priorities in the expensive process of providing clean water. We ought to direct our efforts towards minimizing nutrient yields from all significant sources, and ask how much stopping the yields will cost society. The author suggests that we abandon our preoccupation with obtaining the maximum is the second tion with obtaining the maximum yield per acre and consider instead a system analysis of agricultural ractices that will maximize all benefits to society. (Parker-Iowa State) W72-01558

STORM SEWER GRANT AIDS SEWER IM-PROVEMENTS,

Richmond Dept. of Public Works, Calif. For primary bibliographic entry see Field 04A. W72-01571

USE OF SYSTEMS TECHNIQUES IN ENVIRON-MENTAL QUALITY MANAGEMENT.

National Sanitation Foundation, Ann Arbor, Mich. For primary bibliographic entry see Field 06A. W72-01572

A SYSTEM OF WASTE DISCHARGE RIGHTS FOR THE MANAGEMENT OF WATER QUALI-

Washington Univ., Seattle. Dept. of Civil Engineering. B. W. Mar.

Water Resources Research, Vol. 7, No. 5, p. 1079-1086, October 1971, 3 fig, 1 tab, 15 ref.

Descriptors: \*Water quality control, Waste water treatment, \*Effluents, \*Discharge (Water),

\*Economic efficiency, \*Public utilities, Resource allocation, Water resources development, Optimization

Identifiers: \*Waste discharge rights, \*Willamette

This paper examined the marketing of discharge rights as an alternative tool of water quality management. A system of marketable rights would (1) improve the allocation of the benefits and costs related to water quality in a multiple user-multiple product water resource system, (2) provide further economies of scale by combining regional waste treatment systems with a system of effluent charges and (3) provide a mechanism for adjusting water quality without creating serious economic penalties for others discharging waste or requiring high water quality. The paper proposed that property rights for water quality be established to facilitate the price system. The level of waste di charged must observe the water quality standard at the bounda-ries of the specified area. A water quality manage-ment problem was reviewed to illustrate the proposed rights system. Major rights would be competed for by utilities, whereas minor rights would be purchased by individuals from a utility. Control of waste discharges that impact only seg-ments of a body of water and an institution to increase the water quality standard would be pro-vided by the utility. (Markell-Cornell) W72-01575

THE SUPREME COURT AND INTERSTATE ENVIRONMENTAL QUALITY: SOME NOTES ON THE WYANDOTTE CASE,

Arizona Univ., Tucson. Coll. of Lav For primary bibliographic entry see Field 06E. W72-01641

INTRODUCTION OF WATER POLLUTION

BILL,
For primary bibliographic entry see Field 06E.
W72-01642

CONSERVATIONISTS GO TO COURT.

D. Butcher

American Forests, Vol 77, No 6, p 32-35, 55-57 (June 1971). 4 p, 2 illus, continued in Vol 77, No 7, p 32-35 (July 1971). 4 p, 4 illus.

Descriptors: \*Water pollution control, \*Judicial decisions, \*Remedies, \*Pollution abatement, \*Environmental sanitation, Water quality control, Conservation, Legal aspects, Water law, Natural resources, Federal government, Water pollution, Water quality, Air pollution, Environment, Ecology, Water resources, Adjudication procedure

America's judicial system is finally helping resolve a wide range of natural resource conservation con-troversies. A great variety of law suits have been brought to protect the public's right to a quality en-vironment, because conservationists are finding that the courts are their only resource. These suits deal with problems such as endangered species, pesticides, air pollution, noise pollution, atomic pollution, water pollution, construction abatement, and mineral extraction. Other litigation has dealt with the leasing of oil and gas tracts, dredging, the filling of wetlands, and the preservation of fossil beds. The legal and factual contexts of numerous environmental suits are discussed. Several prominent environmental attorneys and organizations are listed. The gradual erosion of legal obstations cles to environmental suits is examined. Environ-mental lawsuits are not always successful. Gradually, however, case law is being created which will be effective in itself and encourage more vigorous administrative enforcement. (Robinson-Florida) W72-01643

GOVERNMENTAL REGULATION OF OPERA-TIONS ON SUBMERGED LANDS.

For primary bibliographic entry see Field 06E. W72-01644

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# WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

# Water Quality Control—Group 5G

WHO OWNS THE WATER,

J. McCaull. Environment, Vol 12, No 8, p 30-39 (Oct 1970).

Descriptors: "Water pollution control, "Water quality control, "Pollution abatement, "Water resources development, Federal government, Governments, State governments, Foreign countries, Regulation, Standards, Water pollution, Water quality, International joint commissions, International law, Treaties, Delaware River Basin Commission, Legislation, Water law, Legal aspects, Interstate compacts, Interstate compacts, Interstate rivers, Water resources.

The world's rivers cut across national, regional, and state boundaries, unimpressed by legal problems of water control. Present international activity is not sufficient to control water pollution. National pollution control measures, such as the Interstate Commission on the Potomac River Basin and the Federal Water Pollution Control Act, are examined. A survey is presented of water pollution problems and attempted solutions in: (1) Canada, (2) England, (3) France, (4) West Germany, and (5) Hungary. Rivers must be considered in light of their natural basin systems to insure proper utilization and protection of water resources. The proper-ty-minded concept of water ownership may be untenable in light of the array of competing needs for increasingly scarce usable water. (Robinson-W72-01646

THE PROPOSED POTOMAC RIVER BASIN

Virginia Advisory Legislative Council, Richmond. For primary bibliographic entry see Field 06E. W72-01651

INTERSTATE AGENCIES.

Wendell and Schwan, Washington, D.C. M. Wendell.

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In: Proceedings of the Conference on International and Interstate Regulation of Water Pollution, March 12-13, 1970, Columbia University Law School, New York, New York, p 313-317. 5 p.

Descriptors: \*Water pollution control, \*Interstate compacts, \*Interstate commissions, \*New England Interstate WPS Compact, Delaware River Basin Commission, Legal aspects, International law, Water law, Public rights, Administration, Adminis-trative agencies, Jurisdiction, Boundaries (Property), Governments, Federal government, Legislation, Water resources development, Institutions, Interstate commissions, Watersheds (Basins), Ju-risdiction, Non-structural alternatives, Water quality control.

lentifiers: \*Compact Agency on the Ohio River, \*Interstate Sanitation Commission, \*Interstate Commission on the Potomac River Basin.

An interstate water pollution control agency is comparable to the typical state administrative agency, with the exception of its jurisdiction. The agency's reason for being is to solve the jurisdictional problems which arise from pollution in in-terstate waters. The law which gives an interstate agency its authority is generally an interstate compact approved by Congress. The agency may be able to make a uniform body of law applicable to the entire area dealt with by the compact. It has the same geographical sphere of authority which the federal government could exercise: authority over interstate waters. The need for and the place of an interstate agency is more one of policy and procedure than legal necessity. Because water quality control efforts involve minute examination of specific situations and dealings on an individual basis, this form of agency would be more suited to the task than a single, enormous federal agency. There are five existing interstate agencies and several others are in various stages of formulation. Only three of the five agencies have general en-forcement powers. The fourth agency has very limited enforcement power, and the fifth agency is only a recommendatory, information-gathering, and regulatory body. (Johnson-Florida) W72-01652

ISSUES IN OFFSHORE OIL PRODUCTION.

C. J. Olmstead.

In: Proceedings of the Conference on International and Interstate Regulation of Water Pollution, March 12-13, 1970, Columbia University School of Law, New York, New York, p 123-126. 4 p, 3 ref.

Descriptors: \*Oil, \*Oil industry, \*Water pollution sources, \*Water pollution control, Oily water, Ships, Accidents, Pollutants, Damages, Water pol-lution, Oceans, International law, Law of the sea, International waters, Treaties, Legislation.

It is important that both the oil industry and the international community be interested in environ-mental conservation. The international community has primarily been concerned with pollution con-trol of the oceans. The Inter-Governmental Maritime Consultative Organization (IMCO) has attempted to develop conventions dealing with pol-lution of the seas. The major provisions of the Tnternational Convention for the Prevention of Pollution of the Seas by Oil are discussed, along with the implementing of United States legislation. Two other conventions on oil pollution were approved in Brussels in 1969. One dealt with the rights of a coastal state to act against vessels which threaten its coastline by pollution and the other concerned civil liability of ship owners to both governments and third parties. The oil industry has started a private program for compensation for oil cleanup. It is argued that a coastal state has jurisdiction to prescribe laws relating to conduct occurring outside integration with the expensive program of the pr side its territory which has a substantial impact on its territory. Enforcement jurisdiction is a problem, but not an insuperable one. IMCO will likely be the medium for solving these problems. (Robinson-W72-01653

THE UNITED STATES DOMESTIC LEGISLA-TION WITH RESPECT TO OIL POLLUTION FROM VESSELS,

G. W. Paulsen.

In: Proceeding of the Conference on International and Interstate Regulation of Water Pollution, March 12-13, 1970, Columbia University School of Law, New York, New York, p 113-118. 6 p, 7 ref.

Descriptors: \*Water pollution sources, \*Water pol-Justine Control, \*Oil, \*Legislation, Oily water, Water pollution, Water quality, Water quality control, Legal aspects, Water law, Water policy, Pollutants, Accidents, Damages, Ships, Pollution abate-

Present domestic legislation on oil spills provides no protection for private claimants. The Oil Pollu-tion Act of 1924 requires a finding of gross negligence, but that is likely to be found in any major oil spill. The primary problem is thus not with major oil spills. Proposed legislation would provide a second limitation fund for governments and third party claimants. Pending House and Senate bills dealing with the oil spill problem are discussed regarding burden of proof, compensation for injury, proof of financial responsibility, and limitations on liability. While this legislation may provide recovery for cleanup costs, it should not be expected to prevent these major spills from occurring. Minor spills can only be prevented by surveillance and law enforcement. Rigorous enforcement, not new laws, is the solution. (Robinson-Florida) W72-01654

WATER POLLUTION REGULATION IN WEST-GERMANY AND THE RHINE RIVER PROBLEM.

I. U. Maniak.

In: Proceedings of the Conference on International and Interstate Regulation of Water Pollution, March 12-13, 1970, Columbia University School of Law, New York, New York, p 50-58. 9 p.

Descriptors: \*International waters, \*Treaties, \*Water pollution control, \*Foreign countries, Water pollution, Water pollution ources, Water pollution effects, Water pollution treatment, Governments, International law, Industry, Industrial wastes, Cities, Local governments, Municipal wastes, Treatment facilities, Waste water (Pollution), International commissions, Navigable rivers, Identifiers: \*West Germany, \*Rhine River.

The German Federal Water Act is the legal matrix for water pollution control in Germany. Both federal and state water laws control the quantity and quality of water. Some industrialized states have enacted specialized ordinances for additional protection. Government has also assisted in constructing new sewage treatment plants. The Rhine River is the main polluted watercourse; it passes through seven nations and has a navigable length of 560 miles. The Rhine provides a source of drinking water and water for industrial uses and receives waste waters. Increasing expenditures have been made to abate pollution in the Rhine. The German federal government, however, may only regulate matters concerning navigation or flood control. The states bordering the Rhine have therefore begun to regulate water quality and use. Along with the other riparian nations on the Rhine, the European Economic Community has enacted water laws for the Rhine. Furthermore, the riparian nations have formed the International Commission for the Protection of the River Rhine against Pollution to study and advise the nations concerning pollution. Similarly, a Lake Constance Commission has been formed to perform analogous functions there. (Hart-Florida) W72-01655

INTERNATIONAL CONTROL OF MARINE POLLUTION,

United Nations, Office of Legal Affairs.

Natural Resources Journal, Vol 11, No 2, p 296-348, April 1971. 53 p, 152 ref.

Descriptors: \*Water pollution control, \*Water pollution sources, \*International law, \*Sea water, \*Water rights, Jurisdiction, International commis sions, Law of the sea, Waste disposal, Industrial wastes, Domestic wastes, Oil wastes, Radioactive waste disposal, Dredging, Nuclear energy, Nuclear explosions, Accidents, Ships, Compensation, Monitoring, Mining, Exploration, United Nations, Oceanography, Legislation, Legal aspects, Trea-

The prevention and control of marine pollution involves balancing the need to preserve marine environments against the expanding use of marine resources. The article outlines the major causes and forms of marine pollution according to the scientific and technical aspects and the human activities involved; examines existing legal and ad-ministrative controls, the problems that arise, and various proposals offering solutions; summarizes the efforts of national and international organizations to control different facets of pollution; and concludes with a review of present needs and future solutions. The forms of marine pollution considered are: (1) land-based activities such as agricultural use of pesticides and industrial use of heavy metals which pollute via the atmosphere; (2) the disposal of domestic and industrial wastes; (3) radioactive pollution from nuclear testing, from the use of nuclear energy for peaceful purposes, and from the disposal of spent materials; (4) the disposal of military materials, (5) shipborne pollu-tants, especially oil spillages; and (6) mineral exploration and exploitation of the sea bed. In each area the effects of international treaties, conventions, and organizations are discussed. (Rees-Florida) W72-01657

A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL ACT. AS AMENDED.

# Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

#### Group 5G-Water Quality Control

AND FOR OTHER PURPOSES. REFERRED TO THE COMMITTEE ON PUBLIC WORKS, Senate, Washington, D.C.

For primary bibliographic entry see Field 06E. W72-01658

A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL ACT AS AMENDED, AND FOR OTHER PURPOSES. REFERRED TO THE COMMITTEE ON PUBLIC WORKS,

Senate, Washington, D.C. For primary bibliographic entry see Field 06E. W72-01659

#### ENFO NEWSLETTER.

ENFO Newsletter, Environmental Information Center, Florida Conservation Foundation, Inc, Winter Park, Florida, September-October, 1971. 14 p, 4 fig, 1 tab.

Descriptors: \*Water quality control, \*Florida, \*Water supply, \*Water shortage, \*Water resources development, Financing, Water pollution, Water pollution control, Water quality, Pollution abatement, Water conservation, Water costs, Water demand, Water utilization, Land development, Taxes, Costs, Effluents, Planning, Non-structural alternatives, Land use. Identifiers: Effluent charges.

Despite an apparantly abundant water supply, Florida faces the threat of serious water shortages, due to an ever increasing population. Presently, there are sufficient laws to cope with the problem, but there has not yet been an attempt at strict enforcement. Several possible solutions to Florida's water resource problems have been suggested. One method would charge the consumer for the cost producing water. Florida's industries and thrifty housewives would soon find ways to save on water. Another possibility is an effluent charge on the amount of pollutants discharged. This would make it profitable to discharge clean water. Florida must get away from the ancient, outmoded concept that water usage and pollution are separate problems under the jurisdiction of cities and counties. We need statewide land use planning that prepares for future conditions. Such a plan must be rigidly adhered to, regardless of political pressures. It should also require each new development to provide forand pay for--its own water supply and water pollution control. (Gallagher-Florida) W72-01661

NINETY PERCENT FEDERAL FUNDS FOR WATER POLLUTION CLEANUP, House of Representatives, Washington, D.C.

For primary bibliographic entry see Field 06E. W72-01662

LEGISLATION TO REGULATE DUMPING OF WASTE MATERIALS IN COASTAL WATERS, OCEANS AND GREAT LAKES AND ESTABLISH MARINE SANCTUARIES, For primary bibliographic entry see Field 06E. W72-01663

REPRESENTATIVE REID OF NEW YORK IN-TRODUCES BILL TO INCREASE SUBSTAN-TIALLY THE CIVIL PENALTY FOR POLLU-TION OF THE WATER BY OIL,

House of Representatives, Washington, D.C. For primary bibliographic entry see Field 06E. W72-01664

POSITION PAPER ON WATER POLLUTION LAWS: THE SEARCH FOR A BETTER TOMORROW

For primary bibliographic entry see Field 06E. W72-01665

CLEAN WATERS FOR ALABAMA'S ESTUA-

Summary, Alabama's Public Meeting, National Estuarine Pollution Study November 21, 1968, Mobile, Alabama, Federal Water Pollution Control Administration, Atlanta, Georgia. 14 p, 7 photo.

Descriptors: \*Alabama, \*Estuaries, \*Water resources development, \*Project planning, Environmental sanitation, Water users, Industries, Fishing, Recreation demand, Water pollution control, Administrative agencies, Water quality con-trol, Standards, Waste disposal, Waste treatment, Education, Federal government, Land use, Pollu-tion abatement, Legislation. Identifiers: \*Clean Water Restoration Act, \*National Estuarine Pollution Study.

The Clean Water Restoration Act of 1966 authorized the national estuarine pollution study to be conducted by the Federal Water Pollution Control Administration. At public meetings estuarine water users' views concerning water pollution con-trol problems were heard. Their statements are summarized in seven categories: research, responsibility, planning, industry, recreation, commercial fishing, and education. Alabama's Water Improvement Commission has undertaken estuarine management. Speakers commented on whether the federal government should play an advisory or active role in pollution abatement programs. Solutions to estuarine water pollution problems will require extensive research conducted with federal funds. The South Alabama Regional Planning Commission recommended the formation of a regional organization comprised of public officials, industrial and conservation interests to implement and enforce pollution controls. Industrial, recreational, and fishing interests commented upon their respective needs for estuarine management programs to guarantee the continued availability of estuaries. All recognized the necessity of effective water quality controls and multiple-use manage-ment. Commercial fishing interests deplored the effect of untreated wastes upon estuaries. Several universities desired to expand their studies and research while educating the public about estuarine management. (Rees-Florida) W72-01666

WATER POLLUTION CONTROL BY TANKER

TRAFFIC CONTROL,
For primary bibliographic entry see Field 06E.
W72-01667

LEGISLATION DEALING WITH ENVIRON-MENT,

For primary bibliographic entry see Field 06E. W72-01668

ENVIRONMENTAL POLLUTION, House of Representatives, Washington, D.C. For primary bibliographic entry see Field 06E. W72-01669

POLLUTION: THE PLUNDERING OF OUR EN-VIRONMENT,

For primary bibliographic entry see Field 06E. W72-01671

OPINION OF THE JUSTICES (USE OF STATE BONDS TO FINANCE LOANS FOR CONSTRUCTION OF PRIVATE POLLUTION CON-TROL FACILITIES).

For primary bibliographic entry see Field 06E. W72-01672

THE CONSTITUTION, THE PUBLIC TRUST DOCTRINE, AND THE ENVIRONMENT,

Utah Law Review, Vol 1970, No 3, p 388-394, 1970. 7 p. 34 ref.

Descriptors: \*Public rights, \*Public benefits, \*Environmental sanitation, \*Water pollution control, Ecology, Environment, Water pollution, Air pollution, Legal aspects, Environmental effects, Govern-ments, Political aspects, Regulation, Standards, Water resources development. Identifiers: \*Public trust doctrine.

The public trust doctrine is analyzed in order to ex-The public trust doctrine is analyzed in order to explore the effectiveness of private individuals in protecting the environment through legal action. The doctrine is a possible source of private power in environmental action. Through the doctrine the government is made the public guardian of those valuable natural resources which are not capable of self-regeneration and for which substitutes be produced by man. In this role the government has a high fiduciary duty of care and responsibility to the general public, much as has a trustee to a beneficiary. The historical development of the doctrine is traced from the common law to present Supreme Court decisions. Transfers of public trust land will be upheld by courts only when the transfer is necessary for the promotion and benefit interest of the public, the trust beneficiaries. Argument is made for a constitutional right to clean water and air, and to preservation of wilderness areas. When these rights are invaded, the public should have recompense to prevent further degradation. The combination of the public trust concept with the various constitutional bases discussed gives the environmental lawyer an effective tool for combating pollution. (Smiljanich-Florida) W72-01673

OIL AND GAS PRODUCTION. For primary bibliographic entry see Field 06E. W72-01677

#### WHO'S MR. CLEAN.

New Republic, Vol 164, No 18, p 7-8 (May 1, 1971). 2 p.

Descriptors: \*Water pollution control, \*Political constraints, \*Pollution abatement, Environmental sanitation, Federal government, Legislation, Water law, Legal aspects, Water pollution, Water quality, Water quality control, Administration, Administrative agencies, Regulation, Social values, Social aspects, Air pollution, Water policy, Water resources, Political aspects.

After 15 years of federal antipollution activity there is no evidence of reduced water pollution Some progress, however, has been made because concern for the environment has now become an important political issue. Two Nader task force re-ports on air and water pollution have been prepared. The first, 'Vanishing Air', chastised Senator Muskie for his 1967 Air Quality Act. The second, 'Water Wasteland', criticizes both Pre-sident Nixon and Muskie. The Nader Report contends that water pollution laws should take pollution control responsibility away from the states and deprive bureaucrats of their enforcement discretion. It also says that corporations should not be excused because remedial measures are impractical. Nader does like some things in the Nixon and Muskie proposals, but both are criticized for allowing bureaucrats any leeway in deciding when to en-force the law. Nader feels that pollution exists becuase polluters have more influence over government than others. He feels that the solution provisions. (Robinson-Florida)
W72-01678

TAPPING AN OLD LAW TO CATCH POLLU-

Business Week, May 15, 1971, No 2176, p 158. 1

Descriptors: \*Rivers and Harbors Act. \*Permits. \*Water pollution control, \*Water quality control,
\*Pollution abatement, Waste water treatment,
Federal government, State governments, Legal

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### WATER RESOURCES PLANNING—Field 06

#### Techniques of Planning—Group 6A

aspects, Environmental sanitation, Industrial wastes, Effluents, Sanitary engineering, Waste disposal, Waste water disposal, Regulation, Stan-dards, Administrative agencies, Legislation, Water policy, Waste treatment. Identifiers: \*Refuse Act.

The Refuse Act of 1899 is being used to regulate pollution of our water resources. Companies discharging effluents into waterways must apply for a permit from the Corps of Engineers and the Environmental Protection Agency by July 1. Companies must disclose precisely what they are discharging. The effluent's chemical composition, tempera ture, acidity, biochemical oxygen demand, and solids content must be set forth. Both industrialists and environmentalists are critical of the new pro-gram. Companies dislike the costs and the red tape of dealing with two federal regulators and various state agencies. The environmentalists claim that the permits are a license to pollute. Permits can be denied, however, if the pollution is particularly hazardous or if state standards are inadequate. The permit system would be stronger if federal stan-dards applied to all waterways, not just interstate waterways. Senator Muskie and President Nixon are preparing new water quality legislation that would extend federal standards to all water ways covered by the permit program. Another criticism is that the permit system exempts plants discharging wastes into municipal sewage systems. Many of these systems are inadequate. The proposed Nixon-Muskie legislation would also provide money for municipal plants. (Robinson-Florida) W72-01679

THE 1899 REFUSE ACT.

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nits trol. United States Senate. For primary bibliographic entry see Field 06E. W72-01680

A BILL TO REGULATE THE DISCHARGE OF WASTES IN TERRITORIAL AND INTERNA-TIONAL WATERS. Senate, Washington, D.C.

For primary bibliographic entry see Field 06E. W72-01681

LEGISLATION TO END INDISCRIMINATE OCEAN DUMPING.

For primary bibliographic entry see Field 06E. W72-01682

MESSAGE FROM THE PRESIDENT OF EN-VIRONMENTAL QUALITY, Senate, Washington, D. C.

For primary bibliographic entry see Field 06E. W72-01683

A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL ACT TO STRENGTHEN AND IMPROVE AUTHORITY TO ENFORCE ABATEMENT OF POLLUTION, TO PROVIDE FOR FILING OF NOTICE WITH RESPECT TO DISCHARGE OF MATTER INTO INTERSTATE OR N AVIGABLE WATERS AND TO REQUIRE PERMITS TO REGULATE SUCH DISCHARGE OF MATTER.

For primary bibliographic entry see Field 06E. W72-01684

THE DETERGENT POLLUTION CONTROL ACT OF 1970,

Senate, Washington, D. C. For primary bibliographic entry see Field 06E. W72-01685

INTRODUCTION OF BILLS ON ENVIRON-MENTAL CONTROL, Senate, Washington, D. C.

For primary bibliographic entry see Field 06E. W72-01686

WATER POLLUTION PROBLEMS IN CEN-

House of Representatives, Washington, D. C. For primary bibliographic entry see Field 06E. W72-01687

INTRODUCTION OF A BILL ENTITLED NA-TIONAL WATER QUALITY STANDARDS ACT

OF 1970, Senate, Washington, D. C. For primary bibliographic entry see Field 06E. W72-01688

INTRODUCTION OF NATIONAL LEAGUE OF CITIES WATER POLLUTION BILL, Senate, Washington, D. C.
For primary bibliographic entry see Field 06E.
W72-01689

ENVIRONMENTAL INTRODUCTION OF QUALITY ADMINISTRATION ACT OF 1970, Senate, Washington, D. C. For primary bibliographic entry see Field 06E. W72-01690

#### 06. WATER RESOURCES PLANNING

#### 6A. Techniques of Planning

REGRESSION ANALYSIS OF NONLINEAR CATCHMENT SYSTEMS, Auckland Univ. (New Zealand). Dept. of Civil En-

gineering. For primary bibliographic entry see Field 02A. W72-01122

ADEQUACY OF MARKOVIAN MODELS WITH CYCLIC COMPONENTS FOR STOCHASTIC STREAMFLOW SIMULATION,

Instituto Venezolano de Investigaciones Cientificas, Caracuas. For primary bibliographic entry see Field 02A. W72-01123

SOME PROBLEMS OF FLOOD ANALYSIS, Colorado State Univ., Fort Collins. Engineering Research Center. For primary bibliographic entry see Field 04A. W72-01124

GROUNDWATER FLOW IN A SANDY TIDAL BEACH: (1) ONE-DIMENSIONAL FINITE ELEMENT ANALYSIS,

Erindale Coll. (Ontario).

For primary bibliographic entry see Field 02F. W72-01140

ANALYSIS OF GROUND AND SURFACE WATER UTILIZATION IN URBANIZED ARID AREAS.

Nevada Univ., Reno. Center for Water Resources For primary bibliographic entry see Field 04B. W72-01333

THE USE OF CENTRAL PLACE THEORY AND GRAVITY-FLOW ANALYSIS TO DELINEATE ECONOMIC AREAS,

Clemson Univ., S.C. W. W. Hall, Jr., and J. C. Hite. Southern Journal of Agricultural Economics, p 147-153, December, 1970. 1 tab, 3 maps, 8 ref. OWRR B-012-SC (4).

Descriptors: \*Zoning, \*South Carolina, Planning. Identifiers: \*Economic zoning, \*Central place theory, \*Gravity-flow analysis, Commuter patterns, Economic structure, Economic geography

The spatial delineation of economic regions for planning purposes is based on the concepts that each area has spatial units of similar economic structure and character (homogeneity) and that each area is a hinterland of some central place (nodal development or development pole theory).
Central place theory, as a widely accepted theory of economic geography, has been empirically tested as a tool for area delineation. Commuter patterns proved to be a preferable index to measure the attraction of a central place over the hinterland as an economic center. Gravity-flow analysis, a tool as an economic center. Oraniy-how analysis, a tool of the traffic planner, provides an objective basis for assigning a spatial unit to its proper area using the commuter pattern index. The mathematical gravity-flow model was applied to place boundaries on commuter hinterlands for a hierarchy of fourteen central places in South Carolina identified on the basis of concentration of economic activity. Three orders of economic areas were independently delineated and mapped. The central place gravity-flow method proved to be weak in this case, however, because it relied on one measure of interaction (commuter patterns) as the criterion for delineation. (Haugh-Wisconsin) W72-01348

A MACROSYSTEM ANALYSIS OF THE HUMAN ENVIRONMENT,

Pittsburgh Univ., Pa. K. Chen.

Journal of Environmental Systems, Vol 1, No 2, p 133-151, June, 1971. 7 fig, 22 ref.

Descriptors: \*Systems analysis, \*Environmental regineering, "Future planning (Projected), "Model studies, Input-output analysis, "Economic analysis, Economic externalities, Environmental

A macrosystem analysis of the human environment A macrosystem analysis of the human environment on a global and future-oriented basis is needed. The world macroproblem includes the exploding growth of population, technology, and economy and the resultant pressure on ecology, natural resources and all aspects of the human environment. ment. Engineering approaches to the macroproblem include reduction of automobile exhaust pollutants, reduction of thermal pollution from present and future nuclear facilities and increased recycling of waste outputs. Economists note that resources are misallocated because of ex-ternal economies and diseconomies resulting from side effects of a production and consumption process such as pollution. These externalities of the market system can be dealt with by public regulation, by taxes (such as effluent charges) at a rate commensurate with the social costs of pollution, or by internalizing externalities by centralized decision-making. Futurists use computer simulation techniques or more institutionally alternative fu-tures predictions to indicate the kind of world we should expect in the year 2000 and after. The views of the human biologists, ecologists, engineers, economists, futurists, scientists and humanists must be integrated into a macrosystem framework to facilitate public debate and policy discussions. A possible framework is given in this article. (Wade-Wisconsin) W72-01355

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER BASIN, VOL 3, SECTION D - THE DEVELOPMENT OF PREDICTIVE WATER QUALITY MODELS, Wisconsin Univ., Madison. Dept. of Industrial En-

gineering. For primary bibliographic entry see Field 05G. W72-01487

USE OF SYSTEMS TECHNIQUES IN ENVIRON-MENTAL QUALITY MANAGEMENT. National Sanitation Foundation, Ann Arbor, Mich.

Monograph No. 7, p. 1-33, October 1970, 3 fig. 21 ref. 3 append.

#### Field 06-WATER RESOURCES PLANNING

### Group 6A—Techniques of Planning

Descriptors: \*Simulation analysis, \*Environment, \*Management, \*Planning, \*Input-output analysis, Computer programs, Analytical techniques, Proba-

Identifiers: \*Grand Rapids, Dynamo II System, Simscript II Plus System.

A systems analysis team was engaged by the Na-tional Sanitation Foundation to suggest an approach for solving the Grand Rapids Demonstra-tion Project on Environmental Quality. The findings were published in a two-part monograph. The first part broadly defined and discussed the systems approach. The second part described the NSF's application of the systems approach to en-NNF's application of the systems approach to environmental quality management in the Grand Rapids area. A project decision model was developed consisting of 5 parts: (1) problem definition, (2) problem analysis, (3) program planning, (4) program implementation and (5) surveillance. Community attitudes toward environmental problems were surveyed, the problem defined and a goal set. An environmental decision simulator was developed to reduce the uncertainty involved. was developed to reduce the uncertainty involved in program implementation by simulating the out-comes of proposed environmental corrective actions. The objectives of the simulation model de-manded that it have (1) a capacity for providing changes over time in its output relative to causative change in its input; (2) a capacity for considering several hundred dynamic interrelationships between environmental factors; and (3) a common reference for the simulator's subsystems. Various simulation techniques were studied. It was sug-gested that the program be implemented by governmental departments, regulatory agencies, and citizen groups. (Markell-Cornell) W72-01572

#### OPTIMAL CAPACITY OF PORT LOADING FACILITIES,

Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Economics. For primary bibliographic entry see Field 04A. W72-01574

#### FORMULATION OF MATHEMATICAL WATERSHED-FLOW MODEL,

Utah State Univ., Logan; and Illinois Univ., Ur-

C. L. Chen, and V. T. Chow.

Proceedings, American Society of Civil Engineers, Journal of the Engineering Mechanics Division, Vol 97, No EM3, p 809-828, June 1971. 20 p, 3 fig, 35 ref, 2 append.

Descriptors: \*Hydrodynamics, Engineering mechanics, \*Mathematical models, \*Surface ru-Engineering noff, Watersheds (Basins), Rainfall-runoff relation-ships, Channel flow, Overland flow, Rainfall intensity, Boundary conditions, Hydraulics, Friction coefficient (Hydraulic), Fluid flow, Turbulent flow, Unsteady flow, Hydrology, Bibliographies. Identifiers: Navier-Stokes equation.

In a macroscopic hydrodynamic approach, a set of one-dimensional spatially varied unsteady flow equations, that include terms for lateral mass flux, lateral momentum flux, overpressure head due to raindrop impact, and boundary shear, are derived from the equation of continuity and the Navier-Stokes equations for the 3-dimensional flow of viscous incompressible fluid in cooperation with the kinematic and dynamic boundary conditions on the water and ground surfaces of a watershed. The Darcy-Weisbach equation is employed to evaluate the friction slope, and the laminar uniform flow equation for the Darcy-Weisbach friction coeffi-cient coupled with the Karman-Prandtl logarithmic resistance equation for turbulent flow is used to simulate, as a first approximation, the unknown function of the Darcy-Weisbach friction coefficient for watershed surface flow. The proposed mathematical model for watershed surface flow consists of a set of quasilinear partial differential flow equations of hyperbolic type with the appropriately prescribed initial and boundary conditions. prescribed (USBR) W72-01587

#### 6B. Evaluation Process

### ANALYSIS OF GROUND AND SURFACE WATER UTILIZATION IN URBANIZED ARID AREAS.

Nevada Univ., Reno. Center for Water Resources For primary bibliographic entry see Field 04B. W72-01333

#### METHODOLOGY TO EVALUATE SOCIO-ECONOMIC BENEFITS OF URBAN WATER RESOURCES.

Berger (Louis) Inc., East Orange, N.Y.

Available from the National Technical Information Service as PB-204 546, \$3.00 in paper copy, \$0.95 in microfiche. Research, June 30, 1971. OWRR C-2085-(3362)(1).

Descriptors: \*Water resources, \*Water resources development, \*Estimated benefits, \*Direct benefits, \*Indirect benefits, Regression analysis, Discount rate, Property values, Cost-benefit analy-

sis, California, Lakes. Identifiers: \*Urban water resources, Discounting techniques, Present value, Personal interviews, Consumer surplus, Lake Merritt (Calif), Lake Murray (Calif), Santee Lakes.

A methodology for evaluating the benefits of urban water resources is developed and applied to three California lakes, Lake Merritt in Oakland, Lake Murray in San Diego, and the Santee Lakes in Santee. Two techniques were used to quantify benefits. Regression analysis and a series of personal interviews were employed to determine how property values were influenced by proximity to an urban water resource. Interviews were also used to determine the additional amount respondents would be willing to pay rather than be excluded from using the resource. This last approach generated esti-mates of consumer surplus for the water resource. Discounting techniques were then applied to these two benefit streams to derive the present worth of the benefits generated by the lakes. The estimated present values were \$41,038,000 for Lake Merritt, \$1,439,00 for Lake Murray, and \$227,000 for the Santee Lakes. The estimated present values of the resident users' consumer surplus were \$4,117,000 for Lake Merritt, \$165,000 for Lake Murray, and \$273,000 for the Santee Lakes. Numerous tables and graphs elaborate on the calculations and estimates; appendices reproduce the relevant computer regression output and sample interview in-struments. (Settle-Wisconsin) W72-01343

### ECONOMIC STUDIES ON PRODUCTIVITY OF IRRIGATED CROPS AND SOURCES OF IR-RIGATION IN UTTAR PRADESH,

Indian Council of Agricultural Research, New Delhi (India); and Uttar Pradesh Agricultural Univ., Naini Tal (India). Dept. of Agricultural Economics.

For primary bibliographic entry see Field 03F. W72-01346

#### MANAGEMENT GUIDELINES FOR WATER--ORIENTED RECREATION,

Indiana Univ., Bloomington. School of Health, Physical Education and Recreation.

Indiana University, Bloomington, Indiana, Doctor's Thesis, August, 1970. 221 p, 34 tab, 39 ref, 6 append. OWRR B-013-NC (2).

Descriptors: \*Water management (Applied), \*Lakes, \*Recreation, Water sports, Water policy, Water allocation (Policy), Water resources, North Carolina.

Identifiers: \*Management practices, \*Management guidelines

Through personal interviews with the relevant lake officials, management practices and their rationale

were examined on 38 North Carolina lakes in order to develop guidelines for managers on other lakes.
One hundred and seventy-five management guidelines were empirically developed by analysis and synthesis of jury-evaluated management practices. Significant findings of the study included the following: (1) general operating goals and objectives should be documented to provide a policy framework for recreation operations; (2) the managing agency should maintain control of the entire lake shoreline; (3) the agency should maintain public rights to use the shoreline even when private development is allowed; (4) the agency should seek to preserve the aesthetic value of the lake through, say, timber-cutting restrictions; (5) the agency should limit drawdown during the recreation season; (6) the agency should prohibit use of the lake by houseboats; (7) recreational use of lakes serving as primary or secondary water supplies should be permitted; and (8) use of the lake should be limited to the maximum umber that can safely use the area. Numerous tables contain data on management practices; appendices provide an interview outline and a sample evaluation instrument. (Settle-Wisconsin) W72-01347

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# THE USE OF CENTRAL PLACE THEORY AND GRAVITY-FLOW ANALYSIS TO DELINEATE ECONOMIC AREAS,

Clemson Univ., S.C. For primary bibliographic entry see Field 06A. W72-01348

#### EVALUATION OF INVESTMENT IN IRRIGA-TION UNDER RISK,

Illinois Univ., Urbana. Dept. of Agricultural Economics. For primary bibliographic entry see Field 03F. W72-01351

#### INVESTMENT DECISION ON HYDROELEC-TRIC DEVELOPMENT, PART ONE,

Engineering and Power Development Consultants, Sidcup (England).

For primary bibliographic entry see Field 08C. W72-01352

## INVESTMENT DECISION ON HYDROELEC-

TRIC DEVELOPMENT, PART TWO,
Engineering and Power Development Consultants, Sidcup (England). For primary bibliographic entry see Field 08C. W72-01353

## A MACROSYSTEM ANALYSIS OF THE HUMAN ENVIRONMENT, Pittsburgh Univ., Pa.

For primary bibliographic entry see Field 06A. W72-01355

#### SOME GEOGRAPHICAL ASPECTS OF WEST AFRICAN DEVELOPMENT,

London School of Economics and Political Science (England); and London Univ., (England). Dept. of Geography. R. J. H. Church.

Papers in International Studies, Africa Series, No. 10, Ohio University Center for International Studies, 29 p., 1970. 5 fig, 33 ref.

Descriptors: \*Resource development, \*Regional analysis, \*River basins, \*Economic feasibility, Political aspects, Social aspects, Crops, Hydroelectric power, Mining, Harbors, History, Geographical regions, Coasts, Arid lands, Tropical regions, International waters, Irrigation, Navigable rivers, Navigable waters, Geographical regions. Identifiers: \*West Africa.

Africa is a very harsh continent which has had little development in the past; future developmental efforts will face many difficult realities. Too often

planners have generalized about large areas as itf they were uniform regions. This paper attempts to show the differing relative importance of geo-graphical factors over time, and at one time in dif-ferent areas, as well as the influence of history and ferent areas, as well as the influence of history and political decision upon the geography of various countries and areas. West Africa is composed of humid coastal countries, arid nations and various combinations of both. Historically, some countries are former French colonies while others are former English colonies. There are many cultures, languages and even several currencies. The natural resources of the region are surveyed with regard to developmental possibilities. It is obvious that any extensive development must involve cooperation between the many samil countries so that their various overlapping resources may be best utilized. The natural starting points are the major river basins, which may be exploited in terms of navigation, ir-rigation and hydro-electric power. West Africa has few natural harbors and enormous dredging efforts have been necessary. River basin and harbor developments will then facilitate the optimal development of other resources such as minerals, crops and industry. Regional unions have been formed for trade purposes, but have so far been ineffectual in terms of coordinated economic development. The enormous variations in ecomonic, human and physical factors in the region dictate that this situation must change if significant development is to come. (Casey-Arizona) W72-01445

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DIVISION OF AGRICULTURAL AND RESOURCE ECONOMICS,
Nevada Univ., Reno. Div. of Agricultural and

Resource Economics.
For primary bibliographic entry see Field 03F. W72-01466

THE FEDERAL STATE REGIONAL CORPORA-TION, ADDITIONAL ALTERNATIVE AR-RANGEMENTS FOR RIVER BASINS AND OTHER REGIONS: THE FEDERAL-STATE RE-GIONAL GOVERNMENT CORPORATION, National Water Commission, Arlington, Va For primary bibliographic entry see Field 06E.

INTERSTATE WATER COMPACTS, THE INTERSTATE COMPACT AND FEDERAL INTERSTATE COMPACT,

National Water Commission, Arlington, Va For primary bibliographic entry see Field 06E.

FEDERAL-STATE RELATIONS IN WATER LAW, FEDERAL-STATE RELATIONS IN THE LAW OF WATER RIGHTS, National Water Commission, Arlington, Va.

For primary bibliographic entry see Field 06E. W72-01480

WATER AS A POTENTIAL ORGANIZING CON-CEPT IN URBAN REGIONS, 10J. SHEAFFER, Chicago University, Ill. Center for Urban Studies. J. Sheaffer, G. Davis, and H. Bonus.

Available from the National Technical Information Service as PB-204 553, \$3.00 in paper copy, \$0.95 in microfiche. September 1971. 129 p, 23 fig, 2 tab, 68 ref, 7 append. OWRR C-1892 (No 3179) (1).

Descriptors: \*Planning, \*Methodology, \*Water resources, \*Optimum Development Plans, \*City planning, \*Management, \*Decision making, Coordination, Institutional constraints, Model studies, Formulation, Water policy, Optimization, Community development, Cities, Systems analysis, Urbanization, Interagency cooperation, Cities, Or-

ganizations. Identifiers: \*Organizing concept. \*Synergism, \*Urban systems, \*Metropolitan water resource management, Chicago metropolitan area, Denver metropolitan area, Implementation.

The initial question was whether water and water management activities could provide a basis for or-ganizing urban systems in such a way that the planning efforts would adequately deal with interfaces between these systems and thereby integrate faces between these systems and thereby integrate the decision-making process itself. In response to this question an organizing concept was defined and a metholology for utilizing this notion suggested. The organizing concept was defined as a framework of public action which facilitates the identification and implementation of a total urban system. This framework utilizes the specific features of one problem area as a catalyst to develop an organic policy structure that meets the interrelated problems and challenges of a complex environment. Underlying the use of an organizing vironment. Underlying the use of an organizing concept is the concept of synergism. Synergism is an effect which deals uniquely with total system behavior rather than collective efforts of the individual subsystems, producing a total - effect greater than a simple cumulative consideration of ubsystems. Exploratory studies in the Chicago and Denver metropolitan areas indicated that such a methodology was feasible. It was felt that within an outlined context of planning the idea of an organiz-ing concept certainly was a potentially useful planning tool for the total urban system. Also, tenative conclusions indicated that in particular circumstances water resources was a convenient and useful organizing concept. W72-01488

THE APPLICATION OF VALUE THEORY TO WATER RESOURCES PLANNING AND MANAGEMENT,

Institute for the Study of Inquiring Systems, Philadelphia, Pa. R. E. Deal, and M. H. Halbert.

Available from the National Technical Information Service as PB-204 547, \$3.00 in paper copy, \$0.95 in microfiche. November, 1971. 160 p, 36 tab, 4 append. OWRR C-2154 (No 3373) (1).

Descriptors: \*Evaluation, \*Intangible benefits, \*Intangible costs, \*National parks, \*Recreation, Data collections, Delaware River, Methodology, \*Project benefits, Project purposes, \*Social values, Statistical methods, Surveys, Value.
Identifiers: Delaware Water Gap National Recreations tion Area, Factor analysis.

A way to measure non-market benefits or costs of a project was studied using the values of those af-fected. The literature was surveyed to find how 'value' has been defined and used, and prepared an annotated bibliography of articles was surveyed on value aspects of water resource projects. Then three questions to ask about a project: (1) What kinds of people will this project benefit or hurt and in what ways will it benefit or hurt them; (2) How much will it benefit or hurt them; (3) How should we combine the various benefits and hurts (or costs) of individual people to get a cost-benefit ratio for a project. Objective ways were suggested to answer questions one and two, but question three could not be answered without the use of judgement. This approach was demonstrated in a study of the values of 449 potential visitors to the proposed Delaware Water Gap National Recreation Area. This included the development of a questionnaire to identify the satisfactions people derived from outdoor recreation, and a method of data reduction using factor analysis. Nine dimen-sions were stated which can be used to describe the ways people feel about outdoor recreation. W72-01489

SOLVING MAJOR URBAN PROBLEMS,

Chicago Dept. of Public Works, Ill. M. Pikarsky. Public Works, Vol. 102, No. 9, p 69-70, September

Descriptors: \*Environment, \*Planning, \*Decision making, \*Management, \*City planning. Identifiers: \*Chicago Department of Public Works, \*Urban problems, \*Public works, \*Interdisciplinary approach.

The responsibilities of Chicago's Department of Public Works include the development and execution of major capital improvement projects for the City, provision for architectural, engineering, and construction services to other departments, maintenance, building operations, and map services. Urban environmental problems demand an inter-Urban environmental problems demand an inter-disciplinary approach. A change in organizational structure within the Department occurred in March, 1970. The change provided for research and project development capability in the Office of the Commissioner of Public Works. Previously, this responsibility was divided among the bureaus of the Department. The Research and Analyses Division handles the expansion of the architectural and engineering services of the Department. Assignments are accepted on a task basis. The Division does not concentrate on basic or applied research, but is in-volved with short-term study, analyses and review directed toward problem and solution identification. The Project Development Division maintains the Department's Five Year Capital Improvement the Department's Five Year Capital Improvement Program, establishes priorities, develops implementation procedures, and identifies supporting service requirements for the projects involved. Its major concern is the solution of problems common to the early stages of a project. The staff for these divisions includes professionals from the physical and social sciences. (Strachan-Chicago) W72-01562

ON MAN AND HIS ENVIRONMENT,

Jossey-Bass Inc., San Francisco. 1971. 224 p.

Descriptors: \*Environment, \*Planning, \*Decision making, \*Application methods, \*Management, Ecology, Economics, Political aspects, Social aspects, Air pollution, Recreation, Model studies, Methodology, Value, Institutions. Identifiers: \*Sociology, \*Implementation, \*Policy making, Voluntaristic model, Demography, Location theory, Juridical aspects, Noise pollution, Abstract concepts, Social action.

Possible sociological approaches to the study of man and his environment are discussed. These approaches are discussed in terms of their implementation within the planning process. The roles of demographers, ecologists, and location theorists in the development of the study of man and his environment are discussed. A voluntaristic model of vironment are discussed. A voluntaristic model of the man-nature relationship is proposed. This model does not separate the physical and social worlds. Three levels of meaning within environ-mentally oriented social action are distinguished: (1) personality analysis, (2) societal analysis, and (3) cultural analysis. The author identifies four subsystems of managerial organizations which influence environmental policy: (1) economic, (2) policital, (3) juridical, and (4) managerial. Chapters VI and VII examine three environmental problems which are usually regarded simply as physical phenomena. These three environmental problems, air pollution, noise and outdoor recrea-tion, are discussed with respect to the social action which occurs in connection with each problem. In conclusion, the author outlines some of the possible problems involved in environmental planning. Articulation of disciplinary knowledge, distinguishment of abstract concepts and concrete facts, and the integration of these facts to personal and social values, are some fundamental obstacles in any planning process. The author recommends a com-bination of disciplinary research, demonstration, and implementation institutes as the solution to the development of knowledge about man and his relationship to his environment. (Strachan-Chicago) W72-01563

MEASURING IMPACTS OF URBAN WATER

DEVELOPMENT,
Battelle Memorial Inst., Columbus, Ohio.
I. L. Whitman, R. M. Davis, and S. E. Goldston Water Resources Bulletin, Vol 7, No. 4, p 661-669, August 1971. 1 fig. 6 ref.

#### Field 06—WATER RESOURCES PLANNING

#### **Group 6B—Evaluation Process**

Descriptors: \*City planning, \*Social aspects, \*Water resources development, \*Planning, \*Decision making, \*Environment, \*Recreation, Invest-

Identifiers: \*Inner city, \*Water-based recreation, \*Policy making, Economic environment, Social environment, Waterway, Shoreline, Cleveland, Ohio.

The role of water resources in the urban economic and social environment, particularly in the inner city, has never been established to the degree necessary for making informed decisions on investments in urban waterway and shoreline improve-ments. The basic tools for measuring psychological social impacts of waterway and shoreline developments in the inner city have not been fully developed and utilized to date. However, through a detailed analysis of the water resources in the urban core area of Cleveland, it appears that deliberate development of water-based recreation and other environmental resources can lead to improvement in some of the social problems of the inner city. In recreation analysis, there is currently a great gap between methodologies that are conceptually sound and those that have been applied by urban and water-resources planning agencies. New tools and methodologies can only be used successfully when public agencies are given the institu-tional and policy means for using them equitably in light of social needs. Present urban-water planning practices have been found to be biased against the inner city, often unintentionally. (Strachan-Chicago) W72-01564

CULTURAL **ASPECTS** WATER OF RESOURCES DEVELOPMENT PAST. PRESENT, AND FUTURE,

Oregon State Univ., Corvallis. C. L. Smith, and T. C. Hogg. Water Resources Bulletin, Vol. 7, No. 4, p 652-659, August 1971. 1 fig, 17 ref.

Descriptors: \*Water resources development, Population, Management, \*Planning. Identifiers: \*Cultural aspects, \*American West, Development, Economic growth, Evolution, Human adaptation, Planners.

Attitudes toward the development of the American West have undergone important changes over the past century just as the nature of water resources as factors in development have changed. Viewing these changes processually, stages for water resources definition and use can be identified in the total process of western cultural development. The first stage involves the value of water resource development as a stimulus to population and economic growth in the West. The second stage, still in process, adopts a dominant cultural norm which sees water resource development as inevitawhich sees water resource development as inevita-ble if not necessary to keep up with growth. A third stage to this evolutionary process is incipient. Fu-ture cultural values and thinking with respect to water resource development will be to look at development as a means for controlling or managing both the location and quantity of population and economic growth. To this end planners will have to become concerned with the questions of human adaptation. Concern will have to be given to the problems of making a living which enables individuals to meet the subsistence needs of self and family, to establishing community which provides for cooperation among individuals and the management of conflict, to establishing improved communication which promotes interpersonal interaction, and for fostering innovation which provides the new ideas necessary to adapt to new environmental situations. (Strachan-Chicago) W72-01565

**FACTORS IN THE COMMUNITY PERCEPTION** OF WATER RESOURCE PROBLEMS,

Ohio State Univ., Corvallis; and Delaware Univ.,

R. R. Dynes, and D. Wenger. Water Resources Bulletin, Vol. 7, No. 4, p 644-651, August 1971. 7 tab, 2 ref.

Descriptors: \*Water resources development, \*Local governments, "Flood control, Water pollution control, Planning, Decision making, Social aspects. Identifiers: "Community perception, "Communities, "Water resource problems," Solutions.

The study explores the perception of community problems, including flooding and pollution, among leaders in four different communities, ranging in size from 10,000 to 20,000. Water-related problems were considered in the context of other community problems which were defined by these leaders. Among these leaders, water-related problems were characterized by low salience and by low consensus. In seeking solutions, these leaders see water problems as being less likely to be solved at the local community level and to necessitate extra-community assistance. They also see water-related problems as requiring a relatively low water-related problems as requiring a relatively low levels of community coordination and as being primarily the responsibility of the public sector. Local governmental leaders were seen as being more important in problem solving in water-related problems than they were in other community problems. (Strachan-Chicago) W72-01566

EFFICIENT MANAGEMENT POLICIES FOR URBAN WATER SUPPLY, Cornell Univ., Ithaca, N. Y.

D. J. Allee. Water Resources Bulletin, Vol. 7, No. 4, p 774-784, August 1971. 12 ref.

Descriptors: \*Water supply, \*Management, \*Efficiencies, Welfare (Economics), Institutions, Specialization, Economics, Political aspects. Identifiers: \*Strategies, \*Urban, \*Public policy, \*Regional organization, Sub-optimization, Multiple-function, Multiple objective.

This paper attempts to spell out the difficult condi-tions faced by urban water supply managers in achieving overall efficiency. Based upon these conditions and changes that are likely in the next decade, it then tries to suggest strategies that would lead to even higher levels of efficiency in the future. A blending of political and economic con-cepts is used to make what is hoped to be a realistic analysis. What do we mean by 'efficient'. The usual welfare economics definition is attainable only under a very special and highly unrealistic set of in-stitutional arrangements. As soon as we delegate responsibility to a specialized agency we provide the opportunity, indeed we make it imperative that, in a social sense, a sub-optimization will take place. From the specifics of the indictment of this sub-optimization we can learn something about the opportunities for more efficient management in the fu-ture. In general there is an under-exploitation of multiple-function, multiple-objective opportuni-ties. The pressures for sub-optimization hinge very ties. The pressures for sub-optimization hinge very directly on the sources of support and opposition to the water supply agency. A change requires the creation of a broader political base. The search for regional solutions is largely a political problem, and probably the development of flexible, responsive regional agency, so long sought, is still the answer. (Strachan-Chicago) W72-01567

SOCIO-ECONOMIC ACCOUNTING APPLIED TO WATER RESOURCE PLANNING, Auburn Univ., Auburn, Ala.

Water Resources Bulletin, Vol. 7, No. 4, p 634-639, August 1971. 6 ref.

\*Water resources development, Descriptors: \*Planning, \*Management, Methodology, Decision making, Social values, Cost analysis, Model studies. Identifiers: \*Socio-economic accounting, Social measurement, Interdisciplinary research, Social

The growing social consciousness and concern with human well-being has resulted in numerous water resource use and control programs, the results of which must be measured not in the customary monetary terms, but rather in terms of social and human welfare. Interdisciplinary research offers the greatest promise of yielding fruitful results in establishing planning methodology that would result in a maximum utilization of funds available for water resource programs. Working with the various social science disciplines, accountants have begun research in social measurement thus opening door to a new field of accountancy known as socio-economic accounting. The development of social accounting systems will improve water resource management by projecting heretofore un-measurable social values into the management decision making process. (Strachan-Chicago) W72-01568

A RIVER-WASHED MOUNTAIN CUT -- OPEN WAYS FOR URBAN RENEWAL

Corps of Engineers, Washington, D.C. Mary Ann Striffler. Water Spectrum, Vol. 3, No. 3, p 12-19, Fall 1971.

Descriptors: \*Urban renewal, \*Cutoffs, \*Highway relocation, \*Railroad relocation, \*Coordination, Pollution abatement, Flood control, Recreation facilities, Drainage engineering.
Identifiers: \*Pikeville, Kentucky, \*Mountain cut,

\*Riverwashed, \*'Open cut', \*Cooperation, \*River relocation.

The City of Pikeville, Kentucky is engaged in a \$25 million endeavor to solve its problems. The project, which requires the cooperation and coordination of 13 different agencies, involves an 'open cut' in the mountains redirecting the Levisa Fork of the Big Sandy River, U.S. Highway 23, and the Chesapeake sandy River, U.S. righway 25, and the Chesapeake and Ohio (C and O) Railway Company line. The project will also connect U.S. Highway 119 with the relocated U.S. Highway 23, and will provide a major internal access throughfare for Pikeville. The railway freight station and coal loading facilities will be placed outside the city. Additional plans in-clude the rehabilitation of the airport, the construction of a convention center, and development of part of the river for recreational facilities. The rerouting of the river will provide more developable land, part of which will be used for public housing facilities, and the control of all future floods. The removal of the railroad will alleviate the traffic congestion, pollution, and will unify the community. Construction on the project will relieve some of the employment problems. The Army Corps of Engineers is acting as a 'general project manager' over all the government agencies, the C and O Railway Company, and private interests which are involved. The Corps will also be responsible for the solution of the drainage problems once the river is removed. The 'open cut' will instigate the process of urban renewal. (Strachan-Chicago) W72-01570

WATER RESOURCE PROJECTS OF THE CORPS OF ENGINEERS.

For primary bibliographic entry see Field 04A. W72-01675

#### 6C. Cost Allocation, Cost Sharing, Pricing/Repayment

LOW-COST WATER TREATMENT SOLVES DISPOSAL PROBLEMS, Gulf Oil Co, Bakersfield, Calif.

For primary bibliographic entry see Field 05D. W72-01146

ENVIRONMENTAL RESOURCE ALLOCA-TION, Purdue Univ., Lafayette, Ind.

For primary bibliographic entry see Field 05G. W72-01349

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#### WATER RESOURCES PLANNING—Field 06

#### Water Law and Institutions—Group 6E

SOLUTIONS TO POLLUTION: SOME GIVING

AND TAKING, Clemson Univ., S.C. Dept. of Economics. For primary bibliographic entry see Field 05G. W72-01350

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER BASIN, VOL 6, SEC-THE WISCONSIN RIVER BASIN, VOL 6, SECTION H - THE NATURE OF MINIMUM COST SYSTEMS FOR WATER QUALITY MANAGEMENT ON THE WISCONSIN RIVER, Wisconsin Univ., Madison. Dept. of Industrial Engineering; and Wisconsin Univ., Madison. Dept. of Agricultural Economics. For primary bibliographic entry see Field 05G. W72-01486

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER BASIN, VOL 3, SECTION D - THE DEVELOPMENT OF PREDICTIVE WATER QUALITY MODELS, Wisconsin Univ., Madison. Dept. of Industrial En-

gineering. For primary bibliographic entry see Field 05G.

AUTHORITY SOLVES THE 'CREDIT CRUNCH', Manganaro, Martin and Lincoln, New York.

For primary bibliographic entry see Field 05D. W72-01502

A SYSTEM OF WASTE DISCHARGE RIGHTS FOR THE MANAGEMENT OF WATER QUALI-

TY, Washington Univ., Seattle. Dept. of Civil Engineer-For primary bibliographic entry see Field 05G. W72-01575

#### 6D. Water Demand

WATER FOR INDUSTRY AND AGENT IN WASHINGTON COUNTY, MISSISSIPPI, Incheson, Miss., Water WATER FOR INDUSTRY AND AGRICULTURE Geological Survey, Jackson, Miss., Resources Div. For primary bibliographic entry see Field 03E. W72-01399

AN APPRAISAL OF GROUND WATER FOR IR-RIGATION IN THE WADENA AREA, CENTRAL MINNESOTA,
Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 04B. W72-01432

THE CONCEPT OF REASONABLE BENEFICIAL USE IN THE LAW OF SURFACE STREAMS.

For primary bibliographic entry see Field 06E. W72-01656

#### 6E. Water Law and Institutions

TOUGHER ENFORCEMENT OF POLLUTION CONTROLS, R. H. Poff.

Congressional Record, Vol 116, No 24, p H 1151-52 (daily ed. February 23, 1970). 2 p.

Descriptors: \*Political aspects, \*Water pollution control, \*Project planning, \*Remedies, Federal government, State governments, Jurisdiction, Pollution abatement, Legal aspects, Standards, Damages, Administration, Administrative agencies, Waste disposal, Standards, Treatment facilities ties, Water conservation.

Present laws dealing with water polluters are inadequate. Enforcement procedures are umber-some, imprecise, and in many cases there are no specific penalty provisions. Representative Poff considers President Nixon's major porposals aimed at increasing the enforcement power of the Depart-ment of the Interior. First, jurisdiction is sought over boundary and ground waters of the United States affected by pollution in the contiguous zone which extends nine miles beyond the three mile limit, and the high seas where they are con-taminated by United States discharges. Secondly, the President has proposed that states establish new water quality standards based on discharge requirewater quanty standards based on discharge require-ments, thereby enabling allocation of wastes ac-cording to the capacity of receiving waters. Another primary objective of the enforcement ap-proach is to establish new tools with which to move against polluters, and to shorten the time lapse between a conference and the time when it may be necessary to take an individual polluter to court. This would be accomplished by eliminating the hearing state and going directly from an enforce-ment conference to the courts. Penalties include \$10,000 a day fines for noncompliance as well as injunctive relief. (Horwitz-Florida) W71-02670

CLEAN WATER ACT NEEDS CHANGES, House of Representatives, Washington, D.C. John D. Dingell.

Congressional Record, Vol 117, No 28, p E 1486-87 (daily ed March 4, 1971). 2 p.

Descriptors: \*Government finance, \*Water pollution control, \*Sewage treatment, \*Treatment facilities, \*Cities, \*Federal government, Local governments, Financing, Costs, Grants, Capital supply, Water pollution, Water quality, Water quality control, Pollution abatement, Water resources, Water law, Legal aspects, Sewage, Sewage disposal, Waste tisposal, Waste treatment. Identifiers: \*Clean Water Restoration Act.

The Mayor of Detroit, the National League of Cities, and the U.S. Conference of Mayors, appeared before the Senate Subcommittee on Air and Water Pollution to suggest changes in the Clean Water Restoration Act of 1966. All cities are having sewer problems and must develop responsible methods for purifying and disposing of sewage waste. Since the passage of the Act, many cities have received some assistance in constructing waste treatment works, but Detroit has not received what it was promised and has had to raise the federal share itself. This is difficult because Detroit is, as most major cities, experiencing severe financial difficulties. Three obstacles to the present program are that: (1) federal money is grossly inadequate to meet the needs; (2) there is little relation between the allocation of federal funds and the magnitude of a city's problem; and (3) federal money has come in uncertain fits and starts, making long-term planning impossible. The Environmental Protection Agency threatened legal action if water pollution cleanup was not expedited. The federal government, however, has not provided its share. The cities need the help and understanding of the President and the Congress. (Robinson-Florida) W72-01121

#### INTRODUCTION OF THE NATIONAL WATER QUALITY STANDARDS ACT OF 1971,

Senate, Washington, D.C. E. S. Muskie.

Congressional Record, Vol 117, No 9, p S670-72 (daily ed February 2, 1971). 3 p.

Descriptors: \*United States, \*Water quality control, \*Standards, \*Legislation, Government finance, Water pollution, Water pollution control, Federal government, State governments, Adminis-trative agencies, Administration, Treatment facili-ties, Financing, Grants, Legal aspects, Water pollu-tion sources, Adjudication procedure.

Identifiers: \*Water Pollution Control Act, Clean Water Restoration Act.

In introducing expanded water pollution legisla-tion, Senator Muskie of Maine noted that after six years the federal water quality program is still lagging behind Congressional goals. This lag is due to inadequate funding, delays in implementing established standards, and the inaction of a majoriestablished standards, and the maction of a majora-ty of states in adopting standards for all interstate waters. His amendment to the Federal Water Pollu-tion Control Act authorizes two and a half billion dollars in federal grants for each of the next five years: the federal share of twenty-five billion dollars worth of waste treatment plants. It provides incentives to encourage river basin development, the financing of treatment systems for all sources of basin wastes, and the extension of water quality standard programs to all navigable waters. It also provides the following requirements: (1) all new in-dustrial facilities must use navigable pollution con-trol technology, (2) enforceable effluent standards and compliance schedules to be included in impli-mentation plans, (3) all standards must be adopted within a statutory deadline, and (4) new industrial facilities must be certified by state and federal governments. Tighter federal enforcement procedures are provided with citizen suits being permitted. Provisions are specified to assure quality protection in territorial seas through the regulation of ocean dumping. (Shelnut-Florida) W72-01215

#### FASCELL INTRODUCES LEGISLATION TO CONTROL OCEAN DUMPING, House of Representatives, Washington, D.C.

D. B. Fascell.

Congressional Record, Vol 117, No 16, p E670 (daily ed February 11, 1971). 1 p.

Descriptors: \*United States, \*Environmental effects, \*Waste disposal, \*Oceans, \*Legislation, Military aspects, Water pollution, Water pollution control, Legal aspects, Federal government, Administrative agencies, Radioisotopes, Chemicals, Biological warfare, International waters, Oil indus-

Congressman Dante Fascell of Florida has expressed alarm at indiscriminate ocean dumping. He has introduced legislation aimed at the following problems: (1) a lack of national policy on ocean dumping, (2) the growing volume of waste materials dumped into the ocean, (3) the inadequacy of current regulatory authorities to handle the problem, and (4) the need for effective international action. Beginning on the international level, a Fascell resolution calls for an international agreea Fascel resolution can't or an international agreement to prohibit dumping and provide the necessary framework for review and enforcement. In the field of national policy, Fascell proposes a bill empowering the Environmental Protection Agency with the final authority within the executive branch for approval of any plan to discharge military or waste material in international waters. To provide regulation and review of the disposal of military aterial, he is introducing a resolution requiring that before any new munition or chemicals can be introduced into the United States arsenal, there must first be formulated and approved by the Agency a specific date by which it must be disposed and the means of disposal. Provisions for immediate review are also provided. W72-01216

INTRODUCTION OF A BILL TO ESTABLISH AN IMMEDIATE PROGRAM FOR THE PREVENTION OF OCEAN POLLUTION,

Senate, Washington, D.C.

J. C. Boggs. Congressional Record, Vol 117, No 39, p S3371-73 (daily ed March 19, 1971). 3 p.

Descriptors: \*Permits, \*Waste disposal, \*Federal Descriptors: "Permits, "waste disposal, "Federal government, "Legislation, "Oceans, Ships, United States, Administration, Administrative agencies, Legal aspects, Water pollution, Environmental effects, Continental shelf, Pollution abatement, Water pollution sources.
Identifiers: \*Water Pollution Control Act.

#### Field 06-WATER RESOURCES PLANNING

#### Group 6E—Water Law and Institutions

Senator Boggs of Louisiana introduced the Emergency Water Pollution Prevention Act of 1971, a bill to amend the Federal Water Pollution Control Act. It would, upon enactment, declare an immediate moratorium on any ocean disposal of polluting material. During the six-month period following enactment, the Environmental Protection Agency would be required to develop regulations on the future control of ocean dumping through a permit system. A permit would be required to load any vessel with materials that are to be discharged into the ocean, and the Agency could grant a permit only if the discharge would not prove harmful to the environment. Violation of the dumping prohibition or the subsequent permit system would be subject to the civil penalty of not more than \$25,000. The bill further limits future dumping areas beyond the Continental Shelf of North America. Three newspaper articles relating to ocean pollution through arsenic dumping are set forth. (Shelnut-Florida)

MONROE COUNTY CONSERVATION ASS'N V. HANSEN (DENIAL OF MOTION FOR TEMPORARY INJUNCTION TO PREVENT DUMPING DREDGE SPOILS INTO LAKE ONTARIO).

1 Environmental L. Rep. 20362-20364 (W.D. N.Y. June 1, 1971).

Descriptors: \*United States, \*Lake Ontario, \*Waster pollution sources, \*Waste disposal, \*Dredging, Water pollution, Administrative decisions, Rivers, Navigable rivers, Ships, Administrative agencies, Water pollution control, Water pollution effects, Water quality, Water quality control, Lakes, Judicial decisions, Legal aspects, Legislation, Rivers and Harbors Act, Pollutants, Pollution abatement, Spoil banks.

In an action to enjoin defendant Corps of Engineers from the open-water dumping of dredge spoils into Lake Ontario, plaintiff conservation association moved for a preliminary injunction. The dredging sought to be enjoined was authorized by Congress to render a river navigable for commercial deepdraft vessels. Plaintiff contended the dumping of dredge spoils would further pollute Lake Ontario. In the Rivers and Harbors Act of 1970, Congress recognized the problem of dredge-spoils disposal, but deferred mandatory alternative disposal methods. Moreover, the President, by executive order, had established a timetable for pollution abatement in federal projects. Since the proposed disposal would violate neither timetable, nor cause irreparable harm to the Lake, which was already polluted, the United States District Court, Western District of New York, denied plaintiff's motion for a temporary injunction. Although the court doubted plaintiff's ability to maintain the action without the consent of the sovereign, the decision on the motion was not based on sovereign immunity. (Hart-Florida) W72-01229

CASCO V. GOTBAUM (MUNICIPAL TREATMENT FACILITY WORK STOPPAGE ENJOINED AS MALICIOUS POLLUTION OF THE ENVIRONMENT).

323 N.Y.S.2d 742-751 (Sup Ct 1971).

Descriptors: \*New York, \*Labor unions, \*Sewage disposal, \*Public rights, Public health, Sewage treatment, Treatment facilities, Cities, Environmental effects, Discharge (Water), Domestic wastes, Navigable waters, Water pollution, Organizations, Legislation, Remedies, Damages, Local governments, Judicial decisions, Legal aspects, Economic impact, Labor, Municipal wastes.

Plaintiffs, public officials representing a county and various towns, charged defendant union leaders with conspiring and causing unlawful acts of work stoppage and coercion at municipal pollution control plants, pumping stations and yards. Plaintiffs contended the acts resulted in the contamination of

Long Island Sound waters, and sought a permanent injunction, along with compensatory and punitive damages. Defendants moved to dismiss the complaint, alleging that plaintiffs lacked standing to sue, and that no damage had been proven. Defendants contended that the Taylor Law, relating to strikes by municipal employees, sections of both the Public Health Law and the Navigation Law, and the common law supported their motion. The Supreme Court, Special Term, Nassau County, Part 1, denied the motion, holding as a new rule that persons maliciously polluting the environment may be enjoined by the chief executive officer of a county or town whose residents are adversely affected by the offensive conduct or by private citizens reasonably affected. Offensive effect includes economic loss, health hazard, recreational or aesthetic impairment, and destruction of wildlife. Additionally, compensatory damages as proven and punitive damages for deliberate disregard of other environmental rights are recoverable. (Rees-Florida)

UNITED STATES V. UNITED STATES STEEL CO. (VALIDITY OF INFORMATION CHARG-ING VIOLATION OF REFUSE ACT). 328 F. Supp. 354-360 (N.D. Ind 1970).

Descriptors: \*Rivers and Harbors Act, \*Pollution abatement, \*Water pollution control, Riparian rights, Judicial decisions, Standards, Water quality control, Water pollution, Industrial wastes, Legal aspects, Federal government, Legislation, Navigable waters, Riparian land, Waste disposal.

Defendant corporation had been charged with depositing refuse in navigable waters in violation of the Refuse Act. Defendant contended that the information was defective because: (1) it failed to allege that defendant acted wilfully and knowingly, (2) the Act only covers pollution which obstructs navigation, (3) defendant was complying with federal water quality standards, (4) the Refuse Act is unconstitutionally vague, (5) the Act deprived him of his riparian rights without just compensation, (6) the Refuse Act and Control Act together formed an unconstitutional scheme of regulation, and (8) the information failed to allege that the prosecution was undertaken at the request of the Secretary of the Army or other authorized person. The court reasoned that violation of the act was an act malum prohibitum, not malum in se, and could be made the subject of strict criminal liability regardless of the effect on navigation or whether or not federal water quality standards are violated. Since defendant did not allege riparian rights in the property prior to the Refuse Act, the property was subject to the restrictions, and there was no denial of just compensation. The courts upheld the information as proper. (Gallagher-Florida)
W72-01235

UNITED STATES V MAPLEWOOD POULTRY CO. (APPLICABILITY OF RIVERS AND HARBORS ACT TO WASTE DISCHARGES NOT IMPAIRING NAVIGATION).

327 F. Supp. 686-688 (N.D. Me 1971).

Descriptors: \*Rivers and Harbors Act, \*Industrial wastes, \*Water pollution control, \*Navigation, Wastes, Bays, United States, Legislation, Water pollution, Water pollution sources, Water quality, Water quality control, Pollutants, Pollution abatement, Remedies, Legal aspects, Judicial decisions. Identifiers: \*Federal Water Pollution Control Act.

Plaintiff United States obtained an indictment against defendant poultry companies for violation of the Rivers and Harbors Act. Following pleas of nolo contendere, defendants moved for arrest of judgment, arguing that: (1) the Rivers and Harbors Act was never intended to, and does not, apply to discharges not affecting navigation (it was stipulated that defendants' discharges did not impair navigation); and (2) to the extent that the Rivers and Harbors Act applies to discharges not affecting

navigation, it has been superseded by the more comprehensive standards of the Federal Water Pollution Control Act (FWPCA). The Federal District Court, however, noted that the Rivers and Harbors Act prohibited discharges of any refuse matter of any kind or description whatever, and concluded that the Act applied to the disputed discharges Furthermore, the court noted that section 1174 of the FWPCA specifically provides that it shall not affect or impair the Rivers and Harbors Act provisions. Hence the motion for arrest of judgment was denied. (Hart-Florida) W72-01236

FREEMAN V. CONTRA COSTA COUNTY WATER DISTRICT (PREVENTION OF CON-TAMINATION OF PUBLIC WATER SUPPLY FROM AUXILIARY WATER SUPPLY BACK--UP).

95 Cal Rptr 852-856 (Dist Ct App 1971).

Descriptors: \*California, \*Water supply, \*Administrative agencies, \*Water pollution, Administrative decisions, Legal aspects, Legislation, Regulation, Eminent domain, Condemnation, Water wells, Water pollution control, Water pollution sources, Water quality control, Water quality.

Plaintiff homeowners sought to enjoin defendant water district from terminating their water supply. Plaintiffs maintained wells on their respective properties for such purposes as gardening and car-washing. These auxiliary systems were not connected to the public water system operated by defendant. Nevertheless, defendant required plain-tiffs to purchase devices to prevent backup of water from the auxiliary system into the public system and concomitant contamination, under threat of termination of the public water supply. Plaintiffs argued that defendant's action was a taking without compensation and an unreasonable exercise of the police power. The California Court of Appeal stated that no exercise of eminent domain power was present. Administrative regulations required protective devices for actual and potential crossconnections. Stating that the state may take reasonable steps, before the public safety is harmed, to protect a public water supply from potential contamination, the court held that defendant's threat pursuant to the regulation was reasonable. Plaintiffs' contentions were summarily rejected. (Hart-Florida) W72-01244

COLGATE-PALMOLIVE CO. V. HOSKINSON (CONSENT JUDGMENT REGARDING THE ENFORCEMENT OF AN ORDINANCE REGULATING THE SALE OF DETERGENTS CONTAINING PHOSPHORUS).

Orlando Civil Case No. 71-53 (M. D. Fla., May 13, 1971).

Descriptors: \*Water pollution control, \*Phosphorus, \*Detergents, \*Water pollution sources, Regulation, Judicial decisions, Local governments, Water pollution, Legal aspects, Jurisdiction, Federal government, Phosphorus compounds, Water conservation, Administration, Water policy, Water quality control.

Plaintiff detergent manufacturing companies sought an injunction to stop the enforcement of a pollution control ordinance by defendant Board of County Commissioners. Defendant passed an ordinance prohibiting the sale or distribution of detergents containing more than 8.7% phosphorous after March 31, 1971, and prohibiting the sale of detergents containing any phosphorus after January 1, 1972. The trial court denied plaintiffs' motion for a preliminary injunction. The parties then agreed to enter a consent judgment, not' to constitute evidence or admission by either party with respect to any issue of fact or law contained in the judgment. Plaintiffs agreed to comply with the ordinance by either selling detergents which complied with the established requirements or by not

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#### Water Law and Institutions—Group 6E

selling detergens in the county. The parties agreed to meet from time to time to review developments relating to the control of pollution resulting from detergents containing phosphorus. Defendant agreed not to enforce the present statute or any new statutes restricting the use of phosphorus in detergents until 120 days after a formal hearing at which the plaintiffs could be afforded an opportunity to be heard. (Horwitz-Florida) W72-01247

PEOPLE EX REL COUNTY OF DU PAGE V SMITH (CONSITUTIONALITY OF A SEWAGE AND POLLUTION CONTROL ACT). 173 N E 2d 485-493 (111. 1961).

Descriptors: \*Illinois, \*Government finance, \*Sewage treatment, \*Environmental effects, Judicial decisions, Legal aspects, Water law, Local governments, Legislation, Planning, Water pollution control, Taxes, Treatment facilities, Sewage disposal, Costs, Financing, Human population, Distribution patterns, Regulation. Identifiers: \*Mandamus.

Plaintiff county sought to use a mandamus action to test the validity of an act for sewage and pollu-tion control in certain counties. Plaintiff sued to force defendant county treasurer to comply with the act. Defendant contended that sewage treatment plants were not authorized by the act, and counties could not require connection to their sewer systems. Defendant also contended that sewage service charges were unconstitutional, and part of the act was invalid in depriving defendant of custody of public funds. The Supreme Court of Il-linois quashed the writ of mandamus issued by the lower court and held that a statute should be interpreted to include the right to use the means necessary to the beneficial exercise of the expressly conferred powers. The act therefore enabled counties to enact resonable ordinances including provisions for sewage treatment plants. The Court, how ever, quashed the writ because the act improperly allowed plaintiff to strip a constitutional officer of the absolute custody of public funds. (Johnson-Florida) W72-01249

NEWMAN V. NELSON (INSUFFICIENT EVIDENCE TO PROVE PUNITIVE DAMAGES FOR POLLUTION OF POND BY CRUDE OIL FROM STORAGE TANK SEEPAGE).

350 F 2d 602-606 (10th Cir. 1965).

Descriptors: \*Kansas, \*Water pollution, \*Farm ponds, \*Livestock, Damages, Compensation, Oil industry, Oil fields, Oil wells, Saline water intrusion, Storage tanks, Seepage, Water pollution effects, Stream pollution, Water utilization, Competing uses, Remedies, Legislation, Legal aspects, Judicial decisions.

Plaintiffs sought actual and punitive damages for the pollution of a stock pond caused by escaping crude oil from defendant's oil lease operations. Defendant used a botted storage tank to hold crude oil until a sufficient quantity accumulated for gauging and sale; escaping oil seeped into the pond affecting plaintiffs' livestock. On appeal defendant contended a directed verdict should have been granted on the issue of punitive damages for lack of supporting evidence. Defendant did not dispute the award of compensatory damages under the doctrine of liability without fault. The United States Tenth Circuit Court of Appeals reversed the punitive damages award, holding: (1) plaintiffs failed to show facts inferring a reckless indifference by defendant toward the property rights of plaintiffs and (2) defendant was not shown to have maintained persistently any private nuisance. According to the theory of 'retrospective presumption' if equipment is shown to be dilapidated after the leak and seepage, it must be presumed to have been dilapidated at the time of the action. This theory,

however, can not be used to prove any reckless indifference by defendant. (Rees-Florida) W72-01251

NIXON TRIES TO FOLLOW MUSKIE'S CLEANUP ACT.

Business Week, p 21-22, February 6, 1971. 2 p.

Descriptors: \*Political aspects, \*Pollution abatement, \*Financing, \*Legislation, Legal aspects, Federal government, Standards, Permits, Water pollution, Water pollution control, air pollution, Waste disposal, Oceans, Water pollution sources, Environment, Budgeting, Government finance, Interstate rivers, Navigable waters, Pesticides, Gasoline, Fuels, Sulfur.

The political realities behind pollution control legislation for 1972 are considered, with emphasis upon the divergent approaches of President Nixon and Senator Muskie to the problem. President Nixon's most significant proposal is a toxic substances control act which would require any company planning to sell a new chemical to notify the Environmental Protection Agency four months ahead of marketing time. The agency would then decide whether the substance was environmentally safe and therefore eligible for sale. Other proposed legislation for 1972 includes provisions dealing with: (1) extending water quality standards from interstate waters to all navigable waters; (2) expanding the E.P.A.'s power to review the safety of panding the E.P.A. s power to review the sarety or pesticides, and allowing the Agency to suspend im-mediately any pesticide deemed harmful to the en-vironment; (3) permitting the agency to set noise standards for products; (4) reintroducing a tax on leaded gasoline and imposing a new tax on the sul-fur content of fuels; and (5) prohibiting the ocean dumping of wastes without an agency permit. The major political controversy seems to be centered around the financing of these projects, with Senator Muskie pushing for greater funding than President Nixon desires. (Horwitz-Florida)

UNITED STATES V. TRANSIT-MIX CONCRETE CO. (INFORMER'S RIGHT TO ONE-HALF OF FINE UNDER REFUSE ACT), I Environmental L. Rep. 20041-20042 (S.D. N.Y. Dec. 11, 1970).

Descriptors: \*United States, \*Rivers and Harbors Act, \*Public rights, \*Remedies, Non-structural alternatives, Effluents, Water law, Regulation, Administration, Federal government, Legal aspects, Judicial decisions, Legislation, Third party effects, Water pollution sources, Water pollution control, Waste disposal, Industrial wastes, Payment compensation.

Plaintiffs moved for judgment for payment to them of one-half of certain fines paid to the federal government. Defendant corporation had pleaded guilty to discharging refuse matter into a river and was fined \$25,000 for violations of the Refuse Act. Plaintiffs contended they should receive a portion of the fine because they gave information leading to the conviction, as required by the statute. The federal government questioned the claim, but the District Court for the Southern District of New York ruled that the basis for exercise of the court's discretion should be the specific fact pattern present and that, if the discretion is exercised in favor of payment, the amount of the payment must be one-half of the fine. The court concluded that although plaintiffs did not give all, or even a great part of, the information on which the conviction was obtained and although the government had in-formation about discharges of defendant before that given by plaintiffs, nevertheless the information that they gave did, under the circumstances, lead to the conviction of defendant. Plaintiffs were therefore entitled to one-half of the fine. (Johnson-Florida)

RESERVE MINING CO. V MINNESOTA POL-LUTION CONTROL AGENCY (REQUEST FOR VARIANCE FROM POLLUTION CONTROL REGULATIONS).

I Environmental L. Rep. 20073-20077 (Dist. Ct. Minn. Dec. 15, 1970).

Descriptors: "Minnesota, "Industrial wastes, "Waste disposal, "Environmental engineering, Judicial decisions, Legislation, Legal aspects, Water law, Water pollution control, Water pollution sources, Water pollution effects, Jurisdiction, Administrative agencies, Administration, Permits, Economics, State governments, Federal government, Negotiations, Environmental effects, Water quality act, Mining, Wastes.

Appellant corporation challenged the validity of several regulations promulgated by respondent agency, alternatively seeking a variance from these regulations. Respondent counterclaimed for abatement of appellant's alleged polluting activities. Pursuant to a permit from respondent, appellant hadbeen discharging tailings into Lake Superior. Appellant contended that immediate enforcement of the regulations would cause undue hardship, as it would be forced to cease operations, and that a variance should be issued as provided by the regulations. Respondent contended that appellant was polluting in violation of the regulations. The District Court held that the regulations in question were not invalid, but that application of them against appellant would be unreasonable, arbitrary, and invalid, and that a variance should be granted by respondent. The court reached no conclusion as to whether appellant was polluting Lake Superior, but did determine that appellant's present method of discharging tailings should be altered. The court retained jurisdiction to insure that such alteration occurred. It was also noted, in an attached memorandum, that the need to prevent potential harm to the lake water was the basis for requiring appellant to change its methods. (Johnson-Florida) W72-01278

DELAWARE V. PENNSYLVANIA NEW YORK CENTRAL TRANSPORTATION CO. (STAND-ING TO SUE AND JURISDICTION). I Environmental L. Rep 20105-20110 (D. Del. Feb. 24, 1971).

Descriptors: \*United States, \*Federal jurisdiction, \*Dikes, \*Navigation, Judicial decisions, Federal government, State governments, Legal aspects, Jurisdiction, Permits, Adjudication procedure, Water law, Boundary disputes, Easements, Legislation, Negotiations, Regulation, Riparian rights, Rivers and Harbors Act, Landfills, Intertidal aras, Environmental effects, Scenic easements.

Plaintiff state and others sought appropriate declaratory and injunctive relief as well as monetary compensation for damages resulting from the issuance of permits allowing defendant corporation to dike and fill along the foreshore of the Delaware River. Plaintiffs contended that the permits were invalid and that continuance of the operations would cause definite and irreparable harm to plaintiffs. Defendants moved to dismiss, contending that: (1) plaintiffs did not have standing, (2) the court did not have subject matter jurisdiction, and (3) the court did not have pendant jurisdiction over the state matters. The District Court for Delaware ruled that plaintiffs had standing because they met the two-fold test of alleging that the challenged action had caused them injury in fact, economic or otherwise, and the fact that the interest sought to be protected was arguably within the zone of interests sought to be protected by the statutein question. The Court found that it did have subject matter jurisdiction and ruled that rights under state law arising from common operative facts in a definable geographical area were proper subjects for pendant jurisdiction, noting that these claims could be dismissed later if necessary. (Johnson-Florida) W72-01282

### Field 06-WATER RESOURCES PLANNING

#### Group 6E-Water Law and Institutions

SIGETY V. STATE BOARD OF HEALTH (CON-STITUTIONALITY OF DREDGE MINING AND LAND PRESERVATION ACT).
I Environmental L. Rep. 20258-20260 (Mont. Sup.

Ct. March 15, 1971).

Descriptors: \*Montana, \*Legislation, \*Hydraulic mining, \*Land resources, Soil conservation, Mining, Land management, Preservation, Coal mines, Dredging, Exploitation, Land subsidence, Mineral industry, Sluices, Strip mining, Mining engineering, Permits, Administrative agencies, State govern-

Identifiers: \*Constitutionality.

Plaintiff sluice-washing miner challenged the con-stitutional validity of the Montana Dredge Mining Regulations and Land Preservation Act in a suit brought against defendant State Board of Health. The Act required persons conducting mineral recovery operations with mechanical devices of a specified capacity near a stream or riverbed to: (1) obtain a \$100 permit for each ten acres of dredging, (2) furnish a \$10,000 surety bond for each 10 acres, and (3) restore the land to its original condition. Open-pit mining, strip coal mining, irrigation water exits, and gravel extraction were exempted from the Act. The constitutionality of the Act was challenged as a denial of equal protection and a violation of a requirement in the Montana Constitution that the subject matter of an act be expressed in its title. Since the sluice-washing and other mining methods regulated by the Act were not mentioned in its title, the Montana supreme court held that the title did not adequately express the Act's purpose and therefore the Act was unconstitutional. Moreover, since the exempted mining methods were equally deleterious to land, the court held the Act denied equal protection. (Hart-Florida) W72-01283

CONNECTICUT ACTION NOW, INC. V. ROBERTS PLATING CO. (ACTION TO ABATE WATER POLLUTION UNDER REFUSE ACT).

1 Environmental L. Rep. 20370-20371 (D. Conn. June 21, 1971).

Descriptors: \*Rivers and Harbors Act, \*Judicial decisions, \*Water pollution control, \*Adjudication procedure, Legal aspects, Water pollution, Water pollution sources, Legislation, Water quality, Water quality control, Remedies, Streams, Pollu tion abatement, Industrial wastes, Public rights. Identifiers: \*Qui tam actions, Refuse Act.

Plaintiff non-profit corporation brought a qui tam action against defendant industrial corporation to recover the informer's one-half of the criminal penalty for violation of the Rivers and Harbors Act. Plaintiff also sought to enjoin further pollution of the stream Defendant moved to dismiss for lack of subject matter jurisdiction and a failure to state a cause of action. The federal district court recognized that qui tam actions have been permitted where the informer seeks recovery of civil penalties. However, since only the Department of Justice was permitted to enforce the Act, the court held that plaintiff could not maintain a qui tam action until defendant was convicted. Moreover, since plaintiff had not pleaded or proven the jurisdictional amount necessary under 28 U.S.C. 1331, the court held that it had no jurisdiction to entertain the action. The court also determined that no jurisdiction existed under 28 U.S.C. 2461 to recover a criminal fine or forfeiture. (Hart-Florida) W72-01285

AIPLE TOWING CO. V. VOIGHT (NO TEMPO-RARY RESTRAINING ORDER ISSUED UNLESS PARTY SHOWED GOOD CHANCE OF ULTI-MATE SUCCESS).

1 Environmental L. Rep. 20178-20179 (W D. Wisc. April 15, 1971).

Descriptors: \*United States, \*Boating regulations, \*Sewage disposal, \*Navigable rivers, Judicial decisions, Legal aspects, Federal government, State governments, Jurisdiction, Legislation, Regulation, Water pollution, Water pollution sources, Waste disposal, Navigation, Boats, Environmental sanitation, Sewage, Water Quality Act, Mississippi River.

Plaintiff corporations sought a temporary restrain-ing order to prevent defendant state officials from enforcing statutes requiring the retention of wastes on boats operated on the Mississippi River. Plaintiffs argued that application of the statutes was an unreasonable burden on interstate commerce and that, by enactment of the Water Qaulity Improvement Act of 1970, Congress had pre-empted the field of regulation of sewage discharges from boats on navigable waters of the United States. The District Court for the Western District of Wisconsin held that where a question of law exists plaintiffs must establish that they have a reasonably good chance of ultimate success in the decision before a temporary restraining order will be issued. The Court found that plaintiffs had not demonstrated such a probability of ultimate success. The Court also found that state regulation was not pre-empted unless the Secretary of the Interior had promul-gated certain regulations and that he had not done so. Thus, the Court denied the temporary restraining order. (Johnson-Florida) W72-01287

CONSERVATION CALIFORNIA (STANDING TO SUE FOR EN-VIRONMENTAL DEGRADATION). Environmental L. Rep. 20097-20101 (9th Cir.

January 19, 1971).

Descriptors: \*United States, \*Landfills, \*Environmental sanitation, \*Industrial wastes, Judicial decisions, Legal aspects, Water law, Pollution abatement, Water rights, Water pollution control, Water pollution effects, Water pollution sources, Federal government, Environmental effects, Bays, Lagoons, Waste disposal, Environmental engineer-

Plaintiff association and individuals sought to enjoin defendant corporation from filling a portion of San Francisco Bay. Plaintiffs contended that a preliminary injunction should be issued pending the outcome of the case and that the filling of the Bay was illegal and should be permanently halted. Defendant contended that none of the plaintiffs had standing to prosecute the action. The Court of Appeals for the Ninth Circuit ruled that, to have standing, plaintiff association would have had to assert that one of its rights or properties was being infringed or threatened and not merely that one of its purposes was the protection of the public interest in the Bay. The court also ruled that individuals need not reside on property bordering the Bay or its lagoons to have standing. The court ruled that a preliminary injunction should not issue in a doubtful case and found that plaintiffs had not established the strong likelihood or reasonable certainty that they would prevail, which would justify the granting of a preliminary injunction. (Johnson-Florida) W72-01297

TEXAS V. PANKEY (FEDERAL COURT JU-RISDICTION TO DECIDE QUESTION OF WATER POLLUTION FROM PESTICIDE RU-

1 Environmental L. Rep. 20089-20091 (10th Cir February 8, 1971).

Descriptors: \*United States, \*Federal jurisdiction, \*Pesticides, \*Environmental effects, Judicial decisions, Legal aspects, Jurisdiction, Water law, Water pollution control, Pollution abatement, Legislation, State governments, Political aspects, Water pollution sources, Water pollution effects, Animal control, Rivers, Pesticide kinetics, Water rights.

Plaintiff state sought to enjoin defendant ranchers from spraying Toxaphene, a chloronated camphene pesticide, upon their lands in New Mex-ico for eradicating range caterpillars. Plaintiff con-tended that application of this pesticide would poladian River and cause the water to be unusable as the source of water supply for eleven Texas municipalities. Defendants contended that the District Court lacked the proper jurisdiction because the Supreme Court had been granted original jurisdiction in cases where a state was a party and the rights sought to be protected by plaintiff did not involve a federal question. In reversing the District Court, the Court of Appeals for the Tenth Circuit found that the District Court had proper jurisdiction. The Court ruled that the grant of original jurisdiction in the Supreme Court as to all cases in which a state was a party was not exclusive jurisdiction and plaintiff had a choice of courts in which to proceed. The court also held that the federal common law recognized the right of a state to protect against pollution by outside sources and therefore a federal question was involved.
(Johnson-Florida)

UNITED STATES V. DISTRICT COURT IN AND FOR WATER DIV. NO. 5, COLORADO (CONSENT OF U.S. TO BE SUED UNDER 43 U.S.C. PARAGRAPH 666), 91 S. Ct. 1003-1005 (1971).

Descriptors: \*Colorado. \*United States. \*Federalstate water rights conflicts, \*State jurisdiction, Water rights, Legislation, Appropriation, Preferences (Water rights), Prior appropriation, Legal aspects, Judicial decisions, Federal government, State governments, Federal jurisdiction

In this companion case to United States v. District Court for Eagle County, plaintiff United States sought a writ of prohibition in the Colorado supreme court to prevent defendant court from adjudicating water rights reserved by plaintiff. The United States Supreme Court granted certiorari. Since the major issue--the scope of the consent to be sued provision of 43 U.S.C. 666--had been decided in Eagle County, the Supreme Court did not consider it. The instant action, however, involved a different Colorado statute which provided that defendant court was responsible for determining water rights on a monthly basis, but only as to those rights for which an application had been filed within a particular month. Plaintiff contended the action was not a 'general adjudication' under 43 U.S.C. 666. Because the Colorado statutory proceedings reached all claims month by month and was inclusive in the totality, the Supreme Court held that plaintiff had consented to suit through 43 U.S.C. 666 and had been properly joined by defendant. Furthermore, the Court stated that if there is a collision between prior adjudicated rights and reserved rights of the United States, the federal question can be preserved in the state decision and reviewed in the United States Supreme Court. (Hart-Florida) W72-01314

CONTINENTAL OIL CO. V WILLIAMS (RUNNING OF THE STATUTE OF LIMITA-TIONS IN DAMAGES CREATED BY ESCAPING SALT WATER). 250 P. 2d 439-442 (Okla. 1952). 4 p.

Descriptors: \*Oklahoma, \*Oil wastes, \*Water pollution effects, \*Saline water, Water law, Judicial decisions, Legal aspects, Oil, Oil fields, Oil wells, Natural gas, Floods, Water pollution sources, Streams, Wastes, Waste water (Pollution), Mortalister, Emir Streams, Wastes, Waste, W ty, Environmental effects, Soil contamination

Plaintiff landowners sued defendant oil company for damages resulting from salt water discharges into a stream draining through plaintiffs' land. Plaintiffs contended that flooding by the stream caused their land to be impregnated with salt and that this rendered their land unfit for cultivation

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#### WATER RESOURCES PLANNING—Field 06

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and killed a large number of bearing pecan trees. Defendant contended that the statute of limitations barred plaintiffs' action because a portion of the damages sustained by the plaintiffs was caused by deleterious substances deposited on plaintiffs' land more than two years prior to the commencement of the action. In affirming a jury verdict for plaintiffs, the Supreme Court of Oklahoma held that the statute of limitations did not begin to run until the damage was apparent. While from the evidence it appeared that there was a possibility that a flood which occurred earlier than two years before this action contributed to the damage to plaintiffs' land, the court found the evidence sufficient to show that the damages to the land were not apparent until a point in time within the statutory period. (Johnson-Florida) W72-01315

THE MARINE SANCTUARIES STUDY ACT OF 1971 (A BILL TO AUTHORIZE THE SECRETARY OF THE INTERIOR TO STUDY THE MOST DESIRABLE MEANS OF ESTABLISHING CER-TAIN PORTIONS OF THE TIDELANDS, OUTER CONTINENTAL SHELF, SEAWARD ARE AS, AND GREAT LAKES OF THE UNITED STATES AS MARINE SANCTUARIES).

House Bill No 4568, 92d Cong., 1st Sess. (1971. 5

Descriptors: \*Tidal waters. \*Continental shelf. Great Lakes, \*Water resources development, Administrative agencies, Regulation, Industrial water, Recreation facilities, Fisheries, Fishing, Conserva-tion, Investigations, Organizations, International waters, Legislation, Wildlife management, Mining, Exploration, Adjudication procedure, Permits, Planning, Administrative decisions, Water quality control.

Identifiers: \*Marine sanctuaries.

The policy of Congress is to preserve, protect, and encourage the balanced use of and to restore selected parts of the nation's tidelands, Outer Continental Shelf, seaward areas, and the Great Lakes by the creation of a system of marine sanctuaries. Under the proposed bill, the Secretary of the Interior would be authorized to conduct investigations and make recommendations after consultation with other federal agencies and interested public and private organizations. Before establishing marine sanctuaries, the Secretary would hold hearings in areas contiguous to the proposed sanctuary. Until the report is issued, the Secretary would not issue or renew licenses or permits for the Until the report is issued, the Secretary exploration, mining, or removal of minerals includ-ing gas and oil. A moratorium on industrial development is requested in specified areas in cooperation with interested federal, state, local, and international organizations. Two years from the date of enactment the Secretary would report to Congress making recommendations, legislative proposals, and findings as to: (1) present recreation, scenic, wildlife conservation, and ecological values; (2) potential alternative beneficial uses; (3) the best means to reserve and develop these regions; and (4) the most feasible means to create a national system of marine sanctuaries. (Rees-Florida) W72-01321

INTERNATIONAL, REGIONAL, FEDERAL-STATE, INTERSTATE AND FEDERAL OR-GANIZATIONS WITH WATER AND RELATED LAND RESOURCES PROGRAMS IN MIN-NESOTA, 1971, Minagedia, Water Resources Minnesota Univ., Minneapolis. Water Resources

Research Center.

William C. Walton, and David L. Hills.

Available from the National Technical Information Service as PB-204 488, \$3.00 in paper copy, \$0.95 in microfiche. Bulletin 42, 1971. 262 p, 16 fig, 13 tab, 22 ref. OWRR A-021-MINN (2).

Descriptors: \*Water resources. \*Federal government, \*Legislation, Administration, Budgeting, Programs, Coordination, Institutions, \*Minnesota, Organizations, Political aspects, Environment. Identifiers: \*Federal governmental reorganization, \*Legislative process, \*Environment impact state-

This Bulletin is concerned with the inventory of International, regional, interstate, Federal-State, and Federal organizations with activities pertaining to the water and related land resources of Minnesota as of May 1971. There are 5 International, 5 re-gional, 3 interstate, and 4 Federal-State organiza-tions with programs in the State. Federal responsiwater and related land resources planning, development and management in Min-nesota are divided among 30 units in 8 executive departments and agencies; 6 independent agencies; 6 units in the executive office of the president; 9 other boards, committees, councils and commis-sions; and 1 quasi-official agency. In fiscal Year 1970, Federal Outlays for water and related land resources activities in the State totaled about \$75 million or 2.3 percent of total Federal outlays in Minnesota of about \$3.3 billion. There were about 1,300 Federal employees residing in Minnesota in fiscal year 1970 with assignments pertaining to water and related land resources. (Walton-Min-W72-01328

AN EVALUATION OF LEGAL THEORIES CUR-RENTLY EMPLOYED TO DETERMINE WHICH LANDS ARE RIPARIAN,
Missouri Univ., Columbia. Dept of Agriculture

D. R. Levi.

Available from the National Technical Information Service as PB-204 495, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, June 1, 1971. 24 p, 1 fig, 1 ref. OWRR A-027-MO (1).

Descriptors: \*Riparian rights, \*Legal aspects, Boundaries (Property), Evaluation, Missouri, Costs, Irrigation, \*Water utilization, \*Land classifi-

Identifiers: Atlases, \*Howard County (Mo), Unity of title theory, Legal theory.

Atlases for Howard County, Missouri, for the years 1876, 1897, and 1967 were utilized to prepare a map illustrating the extent of riparian land under the chain and unity of title theories for delineating same for a ten mile strip of land immediately west of the east boundary of the county and lying north of the Missouri River. The cost of irrigating tracts at different locations were calculated. It was con-cluded that the unity of title theory, classifying all land as riparian which adjoins a riparian source, is contiguous, and within the same watershed, was the superior legal theory because it provided greater exibility for facilitating water useage on those tracts most productive at the margin. However, it was also concluded that permitting water to be used on land other than that classified as riparian is economically feasible and in some cases the minimum cost method of providing irrigation water. W72-01338

ENVIRONMENTAL QUALITY: THE WET-LANDS OF THE CHESAPEAKE BAY MUST BE

Senate, Washington, D.C.

J. D. Tydings. Congressional Record, Vol 116, No 44, p \$4099-4101 (daily ed. March 20, 1970). 3 p.

Descriptors: \*Estuaries, \*Project planning, \*Federal government, \*Estuarine environment, \*Coasts, Political aspects, Conservation, Legislation, Water pollution, Water pollution control, State governments, Jurisdiction, Legal aspects, Research and development, Coastal marshes, Public rights, Standards, Water quality, Water pol-lution sources, Water pollution effects, Administrative agencies.

The Nation's wetlands are essential to the preservation of marine life and invaluable as habitats for a wide variety of wildlife. These wetlands, however, are ecologically fragile and can easily be destroyed by drainage and development. A comprehensive shoreline plan, along with a state review of all proposals to drain wetlands is needed to preserve e national resources. In 1966 a three-year comprehensive study of the Nation's estuaries was unertaken. These marine resources were found to be invaluable because they supply over 65% of our commercial fish and contain all of the Nation's wetlands. The study shows that our estuaries are seri-ously polluted. The unwise use of the lands and waters of our estuarine zones is rapidly destroying atural resources. The key to more effective use of the Nation's coastline is the introduction of a management system permitting conscious and ined choices between development alternatives. A bill proposed by Senator Tydings is designed to encourage the formation of state coastal zone agencies and provide grants to designated state authorities, upon the development of a master plan. (Hor-witz-Florida) W72-01344

DRINKING WATER QUALITY STANDARDS NEEDED, House of Representatives, Washington, D.C.

H. W. Robison.

Congressional Record, Vol 117, No 58, p E3481-84 (daily ed. April 16, 1971). 4 p.

Descriptors: \*Research and development, \*Standards, \*Water pollution control, \*Water pollution sources, Political aspects, Legal aspects, Legislation, Inspection, Federal government, Water pollu-tion, Water quality, Water pollution effects, Water conservation, Water quality control, Project planning, Public health, Water demand.

Concerned with the need for increased basic and applied research to determine realistic water quality criteria and standards, Representative Robison introduced the statement of Charles C. Johnson, Jr., Associate Executive Director of the American Public Health Association. Mr. Johnson testified, before the Senate Public Works Subcommittee on Air and Water, concerning the principal areas which should be included in final pollution control legislation. The major fault in present legislation is the failure to recognize and support the need for basic and applied research with respect to health effects. Without research, new legislation may be misguided. A sound technical and scientific basis describing the extent of needed legislation is lacking. Furthermore, a surveillance and monitoring system for evaluating the success or failure ased to water pollution control programs will be lacking. The need for research is specifically noted in regard to the existence and effects of viruses in water supplies and the effects of industrial pollutants on water quality measurements. Other areas requiring research include: (1) general methodology, (2) bacteriology, (3) analytical chemistry, and (4) bacterial health hazard identification. (Horwitz-Florida) W72-01345

### FEDERAL WATER POLLUTION CONTROL

House of Representatives, Washington, D.C. O. R. Reid.

Congressional Record, Vol 117, No 56, p E3392-93 (daily ed April 22, 1971). 2 p.

Descriptors: \*Legislation, \*Water pollution con-\*Water quality control, Political aspects, Legal aspects, Water pollution, Water pollution sources, Standards, Administrative agencies, Pollution abatement, Interstate, Water policy, Project planning, Supervisory control (Power), Public rights, Public health, Water quality, Waste rights, disposal. Identifiers: \*Water Pollution Control Act.

The principal deficiencies in the current federal water pollution control law are that: (1) it applies only to water pollution of an interstate character,

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(2) it provides no subpoena power to compel the attendance of polluters at enforcement con-ferences and hearings, (3) it gives polluters far too great a period of time for voluntary compliance with abatement schedules, and (4) it does not authorize or mandate any financial penalties for a failure to comply with an abatement schedule. To remedy these deficiencies Representative Reid introduced a bill that parallels the administration's bill, but has two important differences: it provides a shorter period for compliance with abatement schedules, and it doubles the potential financial penalties. The bill also broadens the coverage of ater quality standards and enforcement provisions to intrastate waters. The Environmental Protection Agency would be empowered to issue orders for prompt remedial action without lengthy hearings. The polluter is allowed 15 days to request a hearing after which the order becomes final. The bill also provides for civil penalties up to \$50,000 per day for violations of final enforcement orders. (Horwitz-Florida) W72-01354

POLLUTION CONTROL FACILITIES, GUIDELINES FOR CERTIFICATION. Environmental Protection Agency, Washington,

Federal Register, Vol 36, No 189, p 19132-19134 (September 1971). 3 p.

Descriptors: \*Taxes, \*Amortization, \*Treatment facilities, \*Industrial wastes, \*Standards, Water pollution, Air pollution, Administration, Administrative agencies, Jurisdiction, Water pollution control, Regulation, Federal government, State governments, Permits, Waste disposal, Supervisory control (Power), Waste treatment.

The Environmental Protection Agency herein establishes guidelines for handling applications for the amortization of pollution control facilities. The guidelines list 12 air pollution control facilities normally eligible for certification. Such devices must be designed for the removal, alteration, disposal, or storage of air pollutants. In determining the boun-daries of these facilities all auxiliary equipment used to operate the control system and all equipment used to handle, store, transport, or dispose of the collected materials are to be included. Water pollution control facilities normally eligible for certification are also listed and include: (1) pretreatment facilities; (2) treatment facilities in com-pliance with established federal, state, and local standards; (3) ancillary devices and facilities; and (4) devices, equipment, or facilities constructed or installed for the primary purpose of recovering a byproduct previously lost either to the atmosphere or to the waste effluent. Examples of eligibility limits are provided. In cases of multiple purpose facilities the Agency must decide the percentage of the cost properly allowable to the abatement function. State certification is a prerequisite to any certification. Other guidelines relate to: (1) facilities serving old and new plants, (2) pollutant dispersal, (3) multiple applications, and (4) profit-making facilities. (Horwitz-Florida) W72-01357

## INTRODUCTION OF THE ENVIRONMENTAL PROTECTION ACT OF 1970,

Senate, Washington, D.C.

G. McGovern. Congressional Record, Vol 116, No 36, p \$3321-25 (daily ed March 10, 1970). 5 p.

Descriptors: \*Pollution abatement, \*Public rights, \*Remedies, \*Legislation, \*Environmental sanition, Pollitical aspects, Water pollution, Water pollution control, Environment, Air pollution, Legal aspects, Judicial decisions, Damages, Federal government, State governments, Jurisdiction, Administration, Administration agencies, Public health, Regulation, Non-structural alternatives.

The Environmental Protection Act, introduced by Senators McGovern and Hart, is designed to ac-complish three things. It would grant all citizens a federally guaranteed right to a pollution free en-vironment. The Bill would give all citizens an effec-tive means of enforcing the right by opening up federal and state court systems to antipollution suits by ordinary citizens against other citizens or government agencies. Finally, the Bill would give citizens standing in federal and state courts to challange lax administrative decision making in the implementation of environmental policy. The Bill provides that each person is entitled by right to the protection, preservation, and enhancement of air, water, land, and public trust of the United States and each person has the responsibility to contribute to the protection and enhancement thereof. Any person may maintain an action for declaratory or equitable relief in his own behalf or in behalf of a class of persons similarly situated, for the protection of the environment from unreasonable pollution. The Act is supplementary to existing administrative and regulatory procedures. (Horwitz-W72-01360

#### A BILL TO PROVIDE FOR THE COMPILA-TION BY THE SECRETARY OF THE INTERI-OR OF A NATIONAL LAND AND WATER IN-VENTORY

House Bill No 659, 92d Cong, 1st Sess. (1971). 5 p.

Descriptors: \*Land use, \*Water utilization, \*Census, \*Water resources development, \*Classification, Land management, Data collections, History, Future planning (Projected), Administrative agencies, State governments, Cities, Water allocation (Policy), Conservation, Recreation demand, Grants, Loans, Taxes, Government finance, Insurance, Federal government, Wetlands, Rivers, Legislation.

The Secretary of Interior in cooperation with federal, state, and local agencies shall compile an inventory of national lands and waters by classifying them, whether under public or private ownership, according to their present and future uses as scenic, scientific, historical, and recreational areas. The secretary shall identify wetlands; mountains; open spaces; rivers; lakes especially suited for future use as recreation, conservation, and fish and wildlife habitats; and those areas within and adjacent to metropolitan areas especially suited for open spaces and recreational use. Compilation and publication shall be within three years from the date of enactment. The Secretary may direct grants to states to facilitate the acquisition of suitable areas, subject to specified cost limitations. For fiscal year 1971 \$10,000,000 is appropriated. For 1975 and thereafter \$50,000,000 is to be appropriated. The Secretary shall in cooperation with the Secretary of the Treasury study federal personal and corporate income tax provisions providsonal and corporate income tax provisions provising incentives for land and mineral development. Recommendations for tax law changes shall be submitted to Congress. Federal agencies are prohibited from providing financial assistance to projects whenever the Secretary declares such projects contrary to future inventory uses or inconsistent with uses for adjacent areas. (Rees-Florida) 18/270.1424.

## SECRETARY HICKEL'S NEW POLLUTION CONTROL RULES SHOULD GO MUCH FURTHER, Proximire.

Congressional Record, Vol 116, No 54, p \$5207-08 (daily ed. April 7, 1970). 2 p.

Descriptors: \*Political aspects, \*Industrial wastes, \*Costs, \*Water pollution control, Legal aspects, Pollution abatement, Water pollution, Water pollution sources, Water pollution effects, Federal government, Project planning, Public health, Treatment facilities, Waste disposal, Financing, Industrial production, Taxes, Environment, Water conservation, Water quality control.

The Hickel plan for pollution control imposes a system of cost recovery which will require those in dustries that feed their wastes into waste treatment facilities built by the federal government, to share part of the operating costs. The industrial share will be in proportion to the amount of waste discharged into the system. Senator Proxmire argues that this plan does not go far enough in establishing a system of effluent charges, and in its place stresses the bill he introduced, entitled the Regional Water Quality Act. This bill would set up a system of effluent charges for all industry, and would establish a series of regional water management associations to administer the program. The plan would provide all industry with an incentive to lessen indiscriminate waste discharges, thereby reducing business costs. Congress must realize that we cannot continue to allow the unfettered use of public resources. Like any other scarce resource, we must allocate the privilege to use the nation's waters with great care, and those who do make use of them should expect to pay for the privilege. (Horwitz-Florida)

# UNITED STATES V. HENRY STEERS, INC. (VESSEL'S RIGHT TO UNOBSTRUCTED NAVIGABLE WATERS PARAMOUNT TO RIGHT OF OWNER OF DAMAGED UNENTRENCHED CABLE).

8 F. Supp. 363-365 (S.D. N.Y. 1934). 3 p.

Descriptors: \*New York, \*Federal government, \*Electric cables, \*Ships, Anchors, Admiralty, Navigation, Water law, Navigable waters, Electricity, Transmission lines, Submergence, Underground, Boats, Harbors, Transportation, Tides, Low water mark, Legislation, Judicial decisions, Legal aspects.

Plaintiff federal government sought damages from defendant tugboat for severing a submarine cable conveying electricity across a channel to Governor's Island. This cable was not entrenched but lay upon the bottom's surface. A posted sign prohibited vessels from anchoring under penalty of law. Witnesses saw an immediate flash from the water as the tugboat with scows in tow passed over the cable at low tide, a depth of six to nine feet. A federal statute provides that lines of telegraph shal be constructed and maintained so as not to obstruct navigation. The Federal District Court, S.D. New York, directed a verdict for defendant, finding that the cable was not entrenched; vessels were warned only against anchoring but not against navigating. Since it was navigable water, vessels had a paramount right to use it free from obstructions. The court also held that since there was nothing to notify the tugboat of the unentrenched cable, the ship master had not been negligent. Since the cable had been laid in a manner to be liable to damage from passing vessels, the cable owner, not the vessel, assumed the risk of damage. (Rees-Florida) W72-0.1365

# CITY OF BIRMINGHAM V. CORR (CITY'S LIABILITY FOR ENCROACHMENT OF DRAINAGE CANAL ON PRIVATE PROPERTY). 157 So. 36-57 (Ala. 1934).

Descriptors: \*Alabama, \*Canal construction, \*Encroachment, \*Canal design, Cities, Drainage Drainage practices, Canals, Real property, Legal aspects, Judicial decisions, Water law, Damages, Property values, Legislation, Remedies, Municipal water.

Plaintiff landowner sought damages from defendant municipality for decreased value of his property. Plaintiff contended his lot was encroached upon and subjected in part to public use without just compensation by defendant's widening and deepening of a drainage canal bordering plaintiff's property. Defendant contended that there could be no recovery against the city unless there was recovery against the contractor who did the drainage canal work. The Supreme Court of Alabama affirmed the lower court judgment for plaintiff and construed a state statute as not requir-

ing prima did the w plans and court also canal was documen W72-013

WOOD VING LAN RIPARIA USE).

Descriptor property, Low water Water law Public be (Property)

Plaintiff n recover pe the street of land we since the by estoppe Appeals judgment given the session of public. De estopped 1 because of trustees fr front. To estoppel, ti (Madsen-F W72-0142

> UNITED S FRANKLI DISTRICT CONDEMI 319 F Supp

Descriptor demnation Real prope decisions, Government Land use.

Plaintiff U land belon controvers certain inte pensation f condemned earlier, by who then o time vested trict. Never district own with the regency that for purpose United Stat Arkansas, c by interver proceedings possibility o was so rem intervention the court he absolute by hence that disputed lan W72-01429

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ing primary liability of the contractor who actually did the work, where the work was done pursuant to plans and specifications furnished by the city. The court also held the width originally dedicated to the canal was properly left to the jury under conflicting documentary evidence. (Madsen-Florida) W72-01366

WOOD V. TOWN OF LEWISPORT (ADJOINING LANDOWNER'S CLAIM OF TITLE TO RIPARIAN LAND DEDICATED TO PUBLIC

221 Ky 566, 299 SW 197-200 (Ky 1927).

Descriptors: "Kentucky, "Riparian land, "Real property, "Stream erosion, Band erosion, Erosion, Low water mark, Judicial decisions, Legal aspects, Water law, Cities, Public rights, Public lands, Public benefits, Boundary disputes, Boundaries (Property), Land tenure, Land use, Right-of-way.

Plaintiff municipality sued defendant landowner to recover possession of a portion of a street in front of defendant's property and a strip of land between the street and the Ohio River. The street and strip of land were dedicated to the public use in the plat of the town. Defendant had been in possession since the river had undermined a portion of the street and it fell into disuse. Defendant claimed title street and it fell into disuse. Defendant claimed title by estoppel and adverse possession. The Court of Appeals of Kentucky affirmed a lower court judgment for plaintiff and held defendant had not given the required statutory notice for adverse possession of riparian land dedicated to the use of the public. Defendant's contention that plaintiff was estopped from asserting title was held unavailing because of a statute which prohibited the board of trustees from conveying any portion of the water-front. To allow waterfront to be disposed of by estoppel, the court stated, would nullify the statute. (Madsen-Florida) W72-01428

UNITED STATES V. 635 ACRES OF LAND IN FRANKLIN COUNTY, ARKANSAS (DRAINAGE DISTRICT RIGHT TO COMPENSATION FOR CONDEMNED LANDS). 319 F Supp 763-772 (W D Ark 1970).

Descriptors: \*Arkansas, \*Land tenure, \*Condemnation, \*Drainage districts, Compensation, Real property, Eminent domain, Payment, Judicial decisions, Legal aspects, Adjudication procedure, Governments, Drainage systems, Flood control,

Plaintiff United States brought action to condemn land belonging to a drainage district. The actual controversy, however, was between the district and certain intervenors over who should receive com-pensation from plaintiff. The disputed lands were condemned by the district almost two decades earlier, by paying compensation to intervenors, who then owned the land. The adjudication at that time vested all right and title to the land in the district. Nevertheless, intervenors contended that the district owned a fee simple defeasible in the lands, with the reversion in intervenors, upon the contin-gency that the lands would be abandoned or used for purposes other than for which condemned. The United States District Court, Western District of Arkansas, did not determine the interest retained by intervenors after the initial condemnation proceedings in state court, but merely held that the possibility of reverter remaining in the intervenors was so remote it was valueless, and dismissed the intervention. On petition for rehearing however, the court held that the district acquired a fee simple absolute by the condemnation in state court, and hence that intervenors had no interest in the disputed lands. (Hart-Florida)

CITY OF ATLANTA V. FLEMING (CITY'S LIA-BILITY FOR NEGLIGENTLY ALLOWING DRAINS TO BECOME CLOGGED). 151 S.E. 678 (Ct. App. Ga. 1930).

Descriptors: \*Georgia, \*Cities, \*Surface runoff, \*Storm drains, Obstruction to flow, Drainage systems, Surface water, Legal aspects, Judicial decisions, Flood damage, Floods, Remedies,

Plaintiff homeowner sued defendant city to recove flood injdry damage to his home. Debris clogged defendant's sewers. Consequently, surface water overflowed into plaintiff's house. In affirming the lower court's decision for plaintiff, the Court of Appeals of Georgia stated that a city was obligated to use ordinary care to maintain a sewer system which it had constructed. The court ruled a city is which it had constructed. In court ruled a city is liable when damage results to private property because city drains became clogged through the ci-ty's negligence. Accordingly, the court held the lower court properly overruled defendant's demurrer to the complaint. (Hart-Florida) W72-01476

GROWING PROBLEM OF OIL SPILLS---REASONS AND REMEDIES. U. S. News and World Report, Feb. 8, 1971, p. 52-54, 3 p, 3 illus, 1 chart.

Descriptors: \*Water pollution control, \*Oil, \*Oil industry, \*Accidents, Federal government, State governments, Legislation, Water law, Legal aspects, Water pollution, Pollution abatement, Environmental sanitation, Offshore platforms, Drilling coasta, Oil fields, Oil wells, Oceans, Water policy, Disasters, Ships, Transportation, Water pol-lution sources Identifiers: \*Oil spills.

Concern has been rising over recent oil spill accidents. A supplemental appropriation bill has been passed giving the Environmental Protection Agency more money to work on the problem. The problem is intensifying because of the following factors: (1) increased oil consumption, (2) more and larger oil tankers, and (3) the increased volume of oil transported by sea. The spill count has been rising yearly. Oil industry groups have been formed to combat and clean up spills. Industrial processing a greater sums for pollution try is also spending greater sums for pollution prevention and control. The federal government and state governments are seeking tougher laws on oil spills. A growing source of oil pollution has come from offshore oil drilling. The United States has sold many oil leases in the Gulf of Mexico. After the Santa Barbara disaster government regulation of offshore drilling increased and the Chilling in the Children of lation of offshore drilling increased markedly. The head of the Environmental Protection Agency has stated that the oil industry must find ways to avoid such accidents or the public will demand increased restrictions on the industry. (Robinson-Florida) W72-01477

THE FEDERAL STATE REGIONAL CORPORA-THE FEDERAL STATE REGIONAL CORFORA-TION, ADDITIONAL ALTERNATIVE AR-RANGEMENTS FOR RIVER BASINS AND OTHER REGIONS: THE FEDERAL-STATE RE-GIONAL GOVERNMENT CORPORATION, National Water Commission, Arlington, Va.

Richard A. Solomon.

Nichard A. Solomon. Available through the National Technical Informa-tion Service as PB-202 997, Cost \$3.00 per copy; \$0.95 microfiche. NWC Legal Study No. 15, Re-port No. NWC-L-71-010, July 1971, 82 p, 2 ap-

Descriptors: \*Government corporations, \*Intergovernmental relations, \*Institutions, \*River basin development, \*Legal aspects, \*Political aspects, Management, Federal project policy, Organiza-

Identifiers: \*Federally chartered corporations.

The study examines the political and legal aspects of the availability of federally chartered corporations as arrangements or mechanisms for interstate tions as arrangement that may be alternatives to TVA-type federal corporations and interstate or federal-interstate compact authorities. Problems of chartering and organizing corporations under federal law and non-federal participation in the corporation together with the legal status of the corporation as a Federal and as a State agency are examined. Appropriate functions and the prospect for the creation of federally chartered corporations are analyzed. Appendices include suggested or sample legislative drafts. (Greer—NWC) W72-01478

INTERSTATE WATER COMPACTS, THE IN-TERSTATE COMPACT AND FEDERAL INTERSTATE COMPACT,

Jerome C. Muys.

Available through the National Technical Information Service as PB-202 998, \$6.00 per copy, \$0.95 microfiche. NWC Legal Study 14, Report no. NWC-L-71-011, July 1971, 455 p, 43 ref, append.

Descriptors: \*Interstate compacts, \*Institutions, \*Institutional constraints, Water resources development, \*Legal aspects, Water allocation, Planning, Flood control, Water pollution control, Regions, Federal project policy, Water policy, Management.
Identifiers: Regional planning, \*Federal-interstate

This legal study explores the history, function, structure and operations of interstate and Federalinterstate water compacts, including water alloca-tion, pollution control, planning, flood control and other kinds of compacts. The Delaware River Basin Compact is used as a case study of the development of the Federal-interstate Compact. The author makes a legal overview of interstate agreements and the compact clause of the U.S. Constitution. He evaluates the compact approach to water management and states specific conclusions and recommendations concerning procedures for the negotiation and execution of compacts. The Federal-interstate Compact is recommended as the preferred, permanent institutional arrangement for regional water planning and management. (Greer-NWC) W72-01479

FEDERAL-STATE RELATIONS IN WATER LAW, FEDERAL-STATE RELATIONS IN THE LAW OF WATER RIGHTS, National Water Commission, Arlington, Va.

Frank J. Trelease.

Available from National Technical Information Service, as PB-203 600, \$6.00 per copy, \$0.95 microfiche. NWC Legal Study No. 5, Report NWC-L-71-014, Sept 7, 1971, 357 p.

Descriptors: \*Federal-state water rights conflicts, \*Water rights, \*Water law, \*Institutional constraints, Reservation doctrine, Adjudication procedure.

This paper describes the sources of conflict between the federal government and the states (and citizens claiming rights under state law); it presents a number of recommendations for resolving the conflicts. Specifically, the paper deals with (1) reserved rights, (2) the navigation servitude, (3) sovereign immunity and (4) eminent domain procedures. A National Water Rights Procedures Act dealing with those subjects is proposed.
(Meyers-NWC)
W72-01480

POWERS OF COMMISSION, (RECREATION AND WATER POLLUTION CONTROL). Wisconsin Stat. Ann. sec. 27.05 (1964), as amended, (Supp 1971).

Descriptors: \*Wisconsin, \*Parks, \*Maintenance, Water pollution control, Aesthetics, Landscaping, Land use, Recreation wastes, Disposal, Recreation, Lakes, Recreation facilities, Grants, Financing, Sewage disposal, Water pollution, Pollution abatement, Streams, Weed control, Water quality control, Administrative agencies, Control, Legal aspects, Legislation.

### Field 06—WATER RESOURCES PLANNING

#### Group 6E-Water Law and Institutions

Supervisory powers over all county parks are vested in county park commissions. Subject to the general supervision of the county board, the commission has the power to: (1) lay out, improve, mission has the power to: (1) hay out, improve, maintain, and govern all such parks; (2) provide for sewage disposal from the parks; (3) accept grants and conveyances to be used for park purposes; (4) buy lands suitable for parks; (5) provide a suitable airport; (6) plant and care for all roadside trees and shrubs authorized by the statute; (7) lease or grant the use of any portion of park lands for industrial fairs, exhibitions, and other public purposes; and (8) control the improvement and maintenance of any public alley, street, or highway made a part of the county park system. The commission is the county park system. The commission is authorized to investigate the pollution of streams and lakes wholly or partially within the jurisdiction of each county by sewage, industrial waste, fertilizers, or other probable causes of water pollution, and to engage in weed control and treatment or any other treatment in order to privide clear, clean water in such lakes and streams. (Gallagher-W72-01483

WATER AS A POTENTIAL ORGANIZING CON-CEPT IN URBAN REGIONS, 10J. SHEAFFER, Chicago University, Ill. Center for Urban Studies. For primary bibliographic entry see Field 06B. W72-01488

KNIGHT V. WEST ALABAMA ENVIRONMEN-TAL IMPROVEMENT AUTHORITY (CON-STITUTIONALITY OF ENVIRONMENTAL IM-PROVEMENT ACT).

I Environmental L Rep 20255-20258 (Ala Sup Ct April 8, 1971).

Descriptors: \*Alabama, \*Legislation, \*Financing, \*Environmental sanitation, Credit, Judicial decisions, Legal aspects, State governments, Administration, Pollution abatement, Water pollution control, Facilities, Public health, Environmental effects, Political aspects, State jurisdiction, Loans, Public rights. Identifiers: \*Constitutionality.

Plaintiff citizen challenged the constitutionality of the Alabama Environmental improvement Authority Act of 1969. The Act authorized the creation of public corporations with the power to issue revenue bonds for the construction of pollution abatement facilities and for financial assistance to private businesses and municipalities for the purpose of controlling environmental pollu-tion. Plaintiff contended that the Act violated state constitutional prohibitions against: (1) state participation in private enterprises, (2) state involvement in internal improvement works, (3) state authorization for a subdivision of the state to lend its credit to a private enterpirse, (4) the creation of new debt by the state, and (5) the illegal delegation of legislative power. The Supreme Court of Alabama held the Act does not violate the Alabama Constitution. The court ruled that a public corporation is a separate entity from the state and its subdivisions and that the prohibitions of the Alabama Constitution are directed to the state, not public corporations. The court also held that the power given to the governor to determine if a proposed public corporation would meet cer-tain standards was a delegation of an administrative and not a legislative power. (Johnson-Florida) W72-01497

UNITED STATES V. ST. REGIS PAPER CO. (RECOVERY OF INFORMER'S ONE-HALF OF FINE PAID BY CONVICTED WATER POL-LUTER UNDER REFUSE ACT OF 1899).

I Environmental L. Rep. 20309-20310 (W.D. Wisc May 26, 1971).

Descriptors: \*Water pollution control, \*Pollution abatement, \*Rivers and Harbors Act, \*United States, Legislation, Judicial decisions, Legal

aspects, Water pollution, Water pollution sources, Remedies, Industries, Water quality, Water quality control, Industrial wastes. Identifiers: \*Oui tam actions. \*Refuse Act.

Claimant United States Congressman sought to recover informer's fees, authorized under the Rivers and Harbors Act, after the conviction of polluters in two federal decisions. Claimant had provided all necessary information for the conviction of two industrial polluters. The statutory language authorizing payment of one-half of the fine to the informer was followed by the phrase 'in the discre-tion of court'. The court determined that this phrase modified the statutory punishment of offen-ders and, therefore, concluded that no discretion existed in allowing the claim. Nevertheless, counsel for the United States contended that the claimant had not 'done enough' to be entitled to recover informer's fees. Since no information beyond that formished by claimant was presented by the prosecution, the court held that the information was sufficient to accord the fee. The government further contended that a Congressman was not a 'person' within the statutory meaning. The court, however, awarded the claim because the fees were not from a private source and the claimant was not obligated to furnish the information. At claimant's no obligated to furnish the information. At claimant's request, the fees were paid to the Wisconsin De-partment of Natural Resources. (Hart-Florida) W72-01503

TECHNICAL AND INSTITUTIONAL ASPECTS OF SEWAGE EFFLUENT-IRRIGATION WATER EXCHANGE, TUCSON REGION.

Arizona Univ., Tucson. C. B. Cluff, K. J. DeCook, and W. G. Matlock. Water Resources Bulletin, Vol. 7, No. 4, p 726-739, August 1971. 2 fig. 1 tab, 8 ref.

Descriptors: \*Water transfer, \*Sewage effluents, \*Irrigation, \*Water reuse, Economic efficiency, Legal aspects, Water quality, Agriculture. Identifiers: \*Arizona, \*Technical and institutional aspects, Municipal use.

Many growing municipalities near irrigated agriculture are advocating a transfer of water now utilized for irrigation to municipal use. Alternatives are presented whereby this water can be transferred to municipal use in exchange for treated sewage effluent. The irrigation water would in effect be cvcled through the municipal system prior to use on the farms. A case study of the Tucson region illustrates the relevant legal, economic and technical aspects. Effluent could be delivered to irrigators in Avra Valley at a cost less than that now paid for water pumped from declining water tables. In return the City of Tucson could import ground water now being used for irrigation through an existing pipeline which presently cannot be used because of a court injunction obtained by the irrigators. It appears that such an exchange agreement could be made without modification of existing statutory law. Similar exchange arrangements may prove to be feasible in other regions containing irrigated agriculture. Increased efficiency of water use can be achieved avoiding external effects which commonly arise in a direct transfer and are difficult to evaluate. High quality water is allocated to municipal use whereas nutrient-rich sewage effluent is transferred to irrigation. (Strachan-Chicago) W72-01569

THE SUPREME COURT AND INTERSTATE ENVIRONMENTAL QUALITY: SOME NOTES ON THE WYANDOTTE CASE,

Arizona Univ., Tucson. Coll. of Law. W. D. Woods, Jr., and K. R. Reed. Arizona Law Review, Vol 12, No 4, p 691-715, Winter 1970. 25 p, 130 ref.

Descriptors: \*Pollution abatement, \*Interstate, \*Jurisdiction, \*Judicial decisions, Water pollution, Water quality control, State governments, Federal government, Legal aspects, Water pollution sources, Damages, Remedies, Industrial wastes, Waste disposal, Political aspects, Environment, Environmental effects.

With the increasing awareness of environmental problems it can be expected that the Supreme Court will, with increasing frequency, be required to adjudicate environmental controversies. Ohio V Wyandotte Chemical Co. is considered a significant case in this area; not for the probl resolves, for it resolves none, but rather for the fun-damental impact that it will have upon the relations between state and federal courts in dealing with environmental problems. The case arose when Ohio sought relief in the Supreme Court against various firms in Michigan and Canada that were polluting Lake Erie. Ohio contended that both federal legislation and the federal constitution gave original jurisdiction to the United States Supreme Court in actions between a state and citizens of other states. The Court, however, refused to hear the case, holding that Ohio's remedy lay in the state courts. The author disagrees with the Court's deci-sion and argues that the federal judicial system is the appropriate forum. To support this position other cases are analyzed, along with the expanding federal role in pollution control as evidenced by recent legislation. (Horwitz-Florida) W72-01641

INTRODUCTION OF WATER POLLUTION

BILL, B. S. Abzug. 117 Cong Rec 8006-8012 (daily ed. August 4,

Descriptors: \*Water pollution control, \*Financing, \*Project planning, \*Legislation, Legal aspects, Administration, Administrative agencies, Federal government, State governments, Jurisdiction, Pollution abatement, Water pollution sources, Waste disposal, Treatment facilities, Grants, Public health, Water conservation, Public rights, health, Water co Remedies, Damages.

This bill is proposed to amend the Federal Water Pollution Control Act by providing for its uniform application to all navigable waters and to provide financial assistance to states and municipalities for water quality enhancement and pollution control. The Administrator of the Environmental Protection Agency is appropriated \$30 million per year for the purpose of making grants to state and inwater pollution control agencies. There is also authorized an annual appropriation of \$5 bil-lion per year for the purpose of making grants for construction of treatment facilities. puts forth detailed funding arrangements that provide for federal grants to cover up to 80% of construction costs of intrastate facilities and up to 90% for construction of river basin facilities. Both construction and enforcement grants are limited by a detailed cost sharing mechanism based upon state population and per capita income. Special provisions are also established covering: (1) water quality standards and implementation of enforcement plans, (2) fines and penalties, (3) emergency pollution control actions, (4) citizens' suits, (5) employer discrimination based upon pollution control activities, and (6) deceptive advertisements of pollution control devices. (Horwitz-Florida)

CONSERVATIONISTS GO TO COURT, For primary bibliographic entry see Field 05G. W72-01643

GOVERNMENTAL REGULATION OF OPERA-TIONS ON SUBMERGED LANDS,

J. B. Connally.
Institute on Oil and Gas Law and Taxation, Vol 21, p 31-46, 1970. 16 p, 32 ref.

Descriptors: \*United States, \*Continental shelf, \*Jurisdiction, \*Submerged Lands Act, State governments, Federal government, Regulation,

Admini tion, Le Political

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coastal s its coast merged over sul coastline could ex daries ar the out vention a technolo gy, partie United S the Secn ing techr It is arg authority pollutant risdiction shelf Th establish limits mu tors, as a shelf wo W72-016

EDENS. REDEVE WATER J. H. Toa South Ca (1971).8

Descripto \*Condem rights, Pu Judicial ( value, W Water res Constitut

There ha Carolina law syster however. private pr is a two-p ists in Sou the police take a nar for which stitutional to restrict change to be review without o broaden ti tle effect. that the c restructur. cases, ho Carolina d tool to fas trial devel W72-0164

WHO OW For primar W72-0164

WISCONS LAND AN For primar W72-0164 Administrative agencies, Administration, Legislation, Legal aspects, Judicial decisions, Water pollu-tion, Water pollution control, Oil industry, Pollutants, Beds, State jurisdiction, Federal jurisdiction, Political aspects.

Around 1950 the Supreme Court held that no coastal state owned the submerged lands lying off its coast. In response Congress enacted the Submerged Lands Act giving coastal states control over submerged lands within three miles of its coastline. However, states on the Gulf of Mexico could extend their jurisdiction up to three marine leagues (about nine miles). These state outer boundaries are important because they determine where the outer continental shelf, and consequently federal regulation, begins. The 1958 Geneva Con-vention attempted to determine the shelf's limits in technological terms. Now with exploding technology, particularly oil and gas operations, there is great uncertainty concerning its outer limits subject to United States control. The commentator criticizes the Secretary of the Interior's regulations governing technological operations and pollution control. It is argued that the Secretary abused federal authority in attempting to regulate the removal of pollutants from the sea and beaches within state jurisdiction, instead of limiting himself to the outer shelf. The regulations may improperly make law by establishing new standards of liability. Reasonable limits must be placed on the liability of shelf operators, as abandoning the search for petroleum on the shelf would be a staggering loss to the economy. (Shelnut-Florida) W72-01644

### EDENS: THE PRIME OBSTACLE TO A REDEVELOPMENT OF SOUTH CAROLINA WATER LAW,

J. H. Toal. South Carolina Law Review, Vol 23, No 1, p 63-70 (1971). 8 p, 35 ref.

Descriptors: \*South Carolina, \*Eminent domain, \*Condemnation, \*Prior appropriation, \*Riparian rights, Public benefits, Water law, Legal aspects, Judicial decisions, Compensation, Condemnation value, Water rights, Water supply, Water sources, Water resources, Public rights, Industries. Constitutionality.

There has been an interest expressed in South Carolina for revamping the existing riparian water law system. A change to an appropriation system, however, could be judicially viewed as a taking of private property without due process of law. There is a two-part problem: (1) a marked distinction exists in South Carolina between eminent domain and the police power and (2) South Carolina courts take a narrow view of what constitutes a public use for which the eminent domain power can be constitutionally invoked. South Carolina courts prefer to restrict the use of the police power so that a change to the appropriation system would probably be reviewed as an exercise of eminent domain without compensation. Legislative attempts to broaden the scope of eminent domain have had little effect. Edens v. City of Columbia demonstrates that the courts have the capacity to devastate a restructuring of South Carolina water law. Two cases, however, provide hope that the South Carolina courts will accept eminent domain as a tool to fashion a role for state government in industrial development. (Robinson-Florida)
W72-01645

#### WHO OWNS THE WATER.

For primary bibliographic entry see Field 05G. W72-01646

WISCONSIN'S REQUIREMENTS FOR SHORE-LAND AND FLOOD PLAIN PROTECTION, For primary bibliographic entry see Field 06F W72-01647

## APPALACHIAN LAND STABILIZATION AND CONSERVATION PROGRAM.

7 Code of Federal Regulations, part 755 (1970). 8

Descriptors: \*Soil conservation. \*Water conservation, \*Łand management, \*Regulation, Water resources, Water resources development, Erosion control, Land reclamation, Land resources, Project purposes, Federal government, State governments, Administrative agencies, Contracts, Federal project policy, Contract administration, Land use, Farm management, Land development management, Land development, Drainage practices.

The Appalachian Land Stabilization and Conserva-tion Program was established to promote economic growth and conservation and development of soil and water resources by contracts providing for land stabilization, erosion and sediment control, reclamation through changes in land use, and the establishment of practices and measures for conservation and development of soil, water, servation and development of soil, water, woodland, wildlife, and recreation resources. Regulations promulgated pursuant to the program delineate the areas involved and define terms used. After establishing general provisions for applying for the program, the regulation sets forth the role of the states in the program. Twenty practices and uses are authorized. The remainder of the regulations covers the following topics: (1) cost-share contracts; (2) cost-share payments; (3) modifica-tion of contract; (4) termination of contracts; (5) noncompliance; (6) signatures; (7) filing of false claims; (8) delegation of authority; (9) reporting performance; (10) handling exceptional cases; (11) access to farms and to farm records; (12) preservation of cropland, crop acreage and allot-ment history; (13) appeals; and (14) availability of funds. (Hart-Florida) W72-01648

#### OBTAINING OF APPROVAL FOR CONSTRUC-TION IN THE TENNESSEE RIVER SYSTEM.

18 Code of Federal Regulations, sec 301.2 (1970).

Descriptors: \*Tennessee River, \*Tennessee Valley Authority Project, \*Permits, \*Dams, Administrative agencies, Administrative decisions, Obstruc-tion to flow, Barriers, Administration, Regulation, Navigation, Structures, Flood damage, Flood protection, Floods, Damages, Legal aspects. Identifiers: \*Administrative procedure.

Approval must be obtained from the Board of Directors of the Tennessee Valley Authority (TVA) before construction of any dam, or other navigational obstruction along the Tennessee River. Each structure requires special approval of the Board. Requests for approval must be in writing and include: (1) maps showing proposed location, (2) scaled plans of the proposed structure, (3) plans for operation and maintenance, and (4) organizations proposing to erect the structure. The Board may require submission of further data. The TVA Division of Reservoir Properties makes the initial investigation and recommendation to the Board, whose decision rests upon the application and the recommendations received. Hearings may be conducted at the applicant's request or if th Board finds hearings necessary. The applicants will be notified in writing of the final determination. Structures not designed for human habitation and costing less than \$1000 may be erected in the flowage easement areas of Fort Loudoun and Doublas reservoirs. In the same areas, structures costing more than \$1000 may be erected without Board approval if not susceptible to flood damage. Also, metal drums may not be utilized for floating structures. (Hart-Florida) W72-01649

#### A BILL TO ESTABLISH A NATIONAL POLICY AND DEVELOP A NATIONAL PROGRAM FOR THE MANAGEMENT, BENEFICIAL USE, PRO-

TECTION, AND DEVELOPMENT OF THE LAND AND WATER RESOURCES OF THE NATION'S COASTAL AND ESTUARINE ZONES.

Senate Bill 582, 92d Cong, 1st Sess (1971). 20 p.

\*Estuaries, \*Coastal marshes, Descriptors: \*Water resources development, Legislation, Administration, Administrative agencies, Federal government, State governments, Regula-tion, Legal aspects, Water law, Water resources, Coasts, Tidal marshes, Salt marshes, Estuarine environment, Loans, Financing, Capital supply, Research and development, Projects, Planning.

In order to provide for a comprehensive, long-range, and coordinated national program in marine science, to establish a National Council on Marine Resources and Engineering Development, and a Commission on Marine Science, Engineering, and Resources, and for other purposes, a proposed amendment to a prior act would provide for the planning and management of the coastal and estuarine zone. The amendment, termed the National Coastal and Estuarine Zone Management Act of 1971, provides definitions of relevant terms.

Management planning and program development may be assisted by grants, administrative grants, and bond and loan guaranties. The Secretary of the Interior would be authorized to review the performance of the coastal states receiving assistance. Grant recipients would be required to keep specified records. A coastal and estuarine zone management advisory committee would assist the Secretary on matters of policy concerning estuarine and coastal zones. Financial aid may also be received for the establishment of estuarine sanctuaries. Procedures for interagency cooperation and coordination are specified. The bill provides for an annual report to Congress of the administration of the Act. (Robinson-Florida)

#### THE PROPOSED POTOMAC RIVER BASIN COMPACT.

Virginia Advisory Legislative Council, Richmond.

Report of the Virginia Legislative Council (January 1970). 79 p, 4 append.

Descriptors: \*Virginia, \*Interstate compacts, River basin commissions, "Watershed management, State governments, Legislation, Water utilization, Water rights, Water resources Water resources development, Water sources, Water supply, Rivers, River regulation, Interstate rivers, Administration, Administrative agencies, Regula-tion, Water law, Legal aspects, Interstate commissions, River basin development, River basins, Watershed management. Identifiers: \*Potomac River.

Due to projected increases in water demand in the Due to projected increases in water demand in the Potomac River Basin, the Virginia General Assembly has directed the Virginia Advisory Legislative Council to report on the proposed Potomac River Basin Compact. The Compact contains provisions dealing with: (1) definitions, purposes, and limitations; (2) organization and territorial jurisdiction of the Potomac River Basin Commission; (3) powers and duties of the Commission; (4) water supply; (5) water quality management and control; (6) flood protection; (7) watershed management; (8) recreation; and (9) hydroelectric management, (8) recreation; and (9) hydroelectric power. The Council recommends that Virginia become a party to the proposed Compact as drafted. It is further recommended that the General Assembly include within the enabling legislation specific provisions establishing an advisory body to assist the Virginia voting member of the Commission created by the Compact. The report also conatom created by the Compact. The report also contains: (1) reasons for the recommendation that Virginia should join the Compact; (2) criticisms of the Compact, and (3) a statement by the dissenting committee members. It was unanimously agreed that a governmental mechanism is needed to preserve the Potomac Basin before pollution destroys; the product (3). preserve the Potomac Basin before polli destroys it beyond repair. (Robinson-Florida)

#### Field 06-WATER RESOURCES PLANNING

#### Group 6E-Water Law and Institutions

INTERSTATE AGENCIES.

Wendell and Schwan, Washington, D.C. For primary bibliographic entry see Field 05G. W72-01652

ISSUES IN OFFSHORE OIL PRODUCTION, For primary bibliographic entry see Field 05G. W72-01653

THE UNITED STATES DOMESTIC LEGISLA-TION WITH RESPECT TO OIL POLLUTION FROM VESSELS,

For primary bibliographic entry see Field 05G. W72-01654

WATER POLLUTION REGULATION IN WEST-GERMANY AND THE RHINE RIVER

For primary bibliographic entry see Field 05G. W72-01655

THE CONCEPT OF REASONABLE BENEFICIAL USE IN THE LAW OF SURFACE CIAL USI STREAMS.

F. Trelease.

In: Economic and Public Policy in Water Resource Development, Iowa State University Press, Ames, Iowa (1970), p 272-292. 21 p, 162 ref.

Descriptors: \*Beneficial use, \*Reasonable use, \*Water users, \*Consumptive use, Water law, Legal aspects, Legislation, Water demand, Water utilization, Prior appropriation, Riparian rights, Water policy, Water resources, Water resources develop-ment, Water permits, Irrigation water, Water requirements, Industrial water, Municipal water, Streams Rivers.

The concept of reasonable beneficial use in water law is discussed through an analysis of the riparian system and the prior appropriation system. The development of the reasonable beneficial use concept is traced both judicially and statutorily. Specific uses found to be beneficial are discussed. In all of the western states, cities and towns are empowered to condemn water rights for municipal supplies. Early preference statutes placed priority on domestic over all other uses, followed by irrigation over manufacturing uses. Legal concepts of reasonable riparian use and beneficial purpose of appropriation act as only a slight check on water users. The courts have just begun to show an awareness of the economic relativity of specific uses and the comparative benefits to be realized from different uses. It is argued that preference statutes are in need of revision. Priority of water uses should be in the following order: (1) human life and health, (2) irrigation and industrial consumption, and (3) uses for which a substitute for water can be found. The future depends more on economists, engineers, and administrators than lawyers. (Robinson-Florida) W72-01656

INTERNATIONAL CONTROL OF MARINE POLLUTION.

United Nations, Office of Legal Affairs For primary bibliographic entry see Field 05G. W72-01657

A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL ACT, AS AMENDED, AND FOR OTHER PURPOSES. REFERRED TO THE COMMITTEE ON PUBLIC WORKS,

Senate, Washington, D.C.

J. J. Williams.
Congressional Record, Vol 117, No 24, p S 2073-2075 (daily ed. February 26, 1971). 3 p.

Descriptors: \*Water pollution control, \*Oceans, \*Waste disposal, \*Environmental sanitation, \*Water pollution control, \*Federal jurisdiction, Sea water, Waste treatment, Sewage sludge, Municipal wastes, Industrial wastes, Water quality

control, Standards, Permits, Navigate waters, United States, Court decisions, Adjudication procedure, Administrative agencies, Treatment facilities, Construction costs, Grants continental shelf, Aquatic life.

Identifiers: \*Water Pollution Control Act.

A bill entitled the 'National Marine Waters Pollu-tion Control and Quality Enhancement Act of 1971' amends the Federal Water Pollution Control Act. It provides means and measures to control the discharge of wastes transported from areas within the United States and to protect and enhance the quality of the marine environment. The owner or operator of a vessel or an onshore or offshore facility is prohibited from discharging wastes into or upon the waters of the contiguous zone without the permission of the Administrator of the Environ-mental Protection Agency. Sewage from marine sanitation devices is excepted from the prohibition. After a public hearing, a civil penalty of not more than \$10,000 may be assessed for each violation. Petition for enforcement, upon a failure to pay, may be made to any United States district court. Regulations governing waste discharges must be promulgated in the Federal Register. Upon written objection to such regulations, the Administrator must conduct a public hearing before final promulgation. Certain existing discharges may continue under specified procedures. Grants may be made to constitute to the construction costs of treatment facilities. The administrator shall publish periodic reports on environmental effects from waste discharges. (Rees-Florida)

A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL ACT AS AMENDED, AND FOR OTHER PURPOSES. REFERRED TO THE COMMITTEE ON PUBLIC WORKS,

Senate, Washington, D.C. W. F. Mondale

Congressional Record, Vol 117, No 24, p S 2079-81 (daily ed. February 26, 1971). 3 p.

Descriptors: \*Lakes, \*Water pollution control, \*Water quality control, \*Federal government, \*Grants, Eutrophication, Government finance, Environmental sanitation, Algae, Nutrients, Industrial wastes, Municipal wastes, Farm wastes, Waste disposal, Pesticide removal, Oxygen sag, Dredging, State governments, Treatment facilities, Administrative agencies, Standards, Remedies.

Many of the Nation's fresh water lakes are deteriorating. A bill entitled the 'Clean Lakes Act of 1971' amends the Federal Water Pollution Control Act to provide for a coordinated rehabilitation program for lakes. The program involves increased waste treatment and lake cleansing, utilizing the latest technology. It has four major points: (1) federal grants for treatment works located near or adjacent to a lake and which discharge treated wastes into the lake or tributary waters would be in-creased to a maximum of 65%, if the state pays at least 20%; (2) technical and financial assistance to states and cities would be provided, including the use of harmless chemicals to destroy algae, the dredging of lake bottoms to remove decaying sludge and other noxious pollutants, and the recovery of overgrowth of algae from the surface; (3) the use of federal water resource agencies to execute the program under agreements with the states; and (4) measures to enforce water quality standards, including penalities and injunctive relief Annual appropriations for treatment works would be \$150 million for fiscal years 1972-1975. (Rees-Florida) W72-01659

STATEMENT IN SUPPORT OF THE CLEAN LAKES ACT OF 1971, Senate, Washington, D.C.

H. W. Cannon.

Congressional Record, Vol 117, No 24, p S 2110 (daily ed. February 26, 1971). 1 p.

Descriptors: \*Lakes, \*Water pollution control, Standards, Water pollution of Pederal government, Eutrophication, Environmental engineering, Water treatment, Water quality control, Standards, Water pollution sources, Water pollution tion effects, Recreation demand, Population, Com-munity development, Environmental effects, Government finance, Technology, Zoning, Algal control, Soil erosion, Cities, Administrative agen-

Identifiers: \*Lake Tahoe.

The proposed Clean Lakes Act of 1971 would be of great value in improving and maintaining the unique purity and clarity of Lake Tahoe. This glacier lake is 22 miles long and 12 1/2 miles wide, but its depth of 1645 feet is being diminished by algae and mud expanding in its waters as a result of man's disturbance of watershed soil. Due to the increa ing population and recreation demands upon Lake Tahoe, it is in danger of prematurely aging-a process called eutrophication. In the last 10 years the fertility of the lake has increased by 72%. This fertilization process has been speeded up by community development projects, lumbering, road-building, and land clearing. A regional planning agency is already establishing standards and con-trols over air and water pollution, zoning, building and the general development of the lake and the surrounding land area. However, the lake needs immediate attention from past neglect. The proposed Act would direct the Environmental Protection Agency to provide technical and financial assistance to states and cities and to conduct a comprehensive program of pollution control and redevelopment of the lake and the surrounding land. (Rees-Florida) W72-01660

ENFO NEWSLETTER.

For primary bibliographic entry see Field 05G. W72-01661

NINETY PERCENT FEDERAL FUNDS FOR WATER POLLUTION CLEANUP.

House of Representatives, Washington, D.C. D. R. Obey. Congressional Record, Vol 117, No 17, p H 675-676 (daily ed. February 17, 1971). 2 p.

Descriptors: \*River basin development, \*Water pollution control, \*Waste treatment, \*Grants, \*Federal government, Government finance, Pollutants, Water pollution sources, Water quality control, Standards, Treatment facilities, Construction costs, Repayment costs, Industries, Industrial wastes, Rural areas, Permits, Navigable waters, Pollution abatement, Administrative agencies, Legislation, State governments, Local governments, Integral control measures.

A comprehensive water pollution abatement measure is herein introduced. Under this bill, 90% federal funds would be provided for water pollution abatement projects included in a river basin plan and in states which have enforceable water quality standards and an adequate matching grant program. Other proposals in the bill deal with: (1) allocating \$4 billion per year, for 5 years, to states and localities for the construction of waste treatment facilities; (2) requiring certain treatment plants to be part of a river basin program; (3) reallocating funds unused at the end of the fiscal year to more needy states; (4) making \$40 million of the \$4 billion available for reimbursement to states having prefunded the federal share of treatment projects or localities having severe pollution needs; (5) prohibiting federal grants for projects designed solely to treat industrial wastes; (6) requiring industry to share project expenses where industrial wastes are treated by a municipality; (7) prohibit-ing the discharge of hazardous substances; (8) prohibiting ocean dumping without a permit; and (9) extending water quality standards to all navigable waters and tributaries. (Rees-Florida) W72-01662 LEGI WAS OCE Cong. 689 ( Descr

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POSITIO LAWS:

#### Water Law and Institutions—Group 6E

LEGISLATION TO REGULATE DUMPING OF WASTE MATERIALS IN COASTAL WATERS OCEANS AND GREAT LAKES AND ESTABLISH MARINE SANCTUARIES,

Congressional Record, Vol 117, No 17, p H 688-689 (daily ed. February 17, 1971). 2 p.

Descriptors: \*Legislation, \*Sea water, \*Waste disposal, \*Environmental sanitation, \*Aquatic life, Water pollution control, Sludge disposal, Radioactive waste disposal, Industrial wastes, Solid wastes, Dredging, Waste treatment, Water quality control, Standards, Permits, Estuaries, Coasts, Great Lakes, Ships, Marine fisheries, Administrative agencies, Government finance.

This legislation has a threefold approach. Instead of designating areas where dumping may be conducted safely, the bill determines which areas are most valuable to be set aside as sanctuaries. Dumping of waste material into the oceans, coastal waters, and estuaries except under a permit signed by the Administrator of the Environmental Protec-tion Agency is prohibited. The bill proscribes ab-solutely the dumping of toxic, radioactive, or chemical biological warfare material. The vehicle for this bill is the act of August 3, 1968, which declared as a national policy the protection and conservation of estuarine areas. Section 3 of the bill outlines the procedure for establishment of marine sanctuaries by the Secretary of Commerce acting through the National Oceanic and Atmospheric Administration, in conjunction with the Secretary of the Interior, the Administrator of the EPA and the Council on Environmental Quality. The bill proposes the phasing out of the dumping or disposal of municipal sewage or industrial waste and establishes a timetable for the construction and use of secondary and tertiary treatment facilities. Stringent enforcement measures are provided, including the use of fines and criminal investigatory procedures to search vessels. (Rees-Florida) W72-01663

REPRESENTATIVE REID OF NEW YORK INTRODUCES BILL TO INCREASE SUBSTANTIALLY THE CIVIL PENALTY FOR POLLUTION OF THE WATER BY OIL,

House of Representatives, Washington, D.C. O. R. Reid.

Congressional Record, Vol 117, No 7, p H292 (daily ed. January 29, 1971). 1 p.

Descriptors: \*Water pollution control, \*Oil industry, \*Remedies, \*Federal government, \*Water Quality Act, Legislation, Hazards, Damages, Ships, Industrical wastes, Accidents, Pollution abatement, Water pollution, Jurisdiction, Water pollution sources, Legal aspects, Political aspects, Oil, Water pollution effects, Navigable waters. Identifiers: \*Oil spills.

The Water Quality Improvement Act of 1970 provides a maximum penalty of \$10,000 for each unlawful discharge of oil into the navigable waters, shoreline areas, and contiguous waters of the United States. It also limits liability for the costs of cleaning up an oil spillage. A bill introduced by Representative Reid would increase the maximum criminal penalty for failure to report an oil spillage from \$10,000 to \$100,000. It would also make any willful or negligent discharge of oil a violation. The Secretary of the department under which the Coast Guard is operated would be required to appoint an Oil Pollution Hearing Board to investigate viola-Oil Pollution Hearing Board to investigate viola-tions. The Secretary would be required to assess a civil penalty against any persons, including cor-porations, whom the Board finds to be a violator. The penalty would be fixed by multiplying \$10 by the number of gallons of oil found to have been discharged. The violator would also be made liable without limitation for all cleanup costs. (Horwitz-Florida) W72-01664

POSITION PAPER ON WATER POLLUTION LAWS: THE SEARCH FOR A BETTER TOMORROW.

Congressional Record, Vol 117, No 80, p E5140-42 (daily ed. May 27, 1971). 3 p, 20 ref.

Descriptors: \*Water pollution control, \*Pollution abatement, \*Legislation, \*Federal government, Political aspects, Project planning, Legal aspects, Standards, Public health, Water pollution, Water pollution sources, Water pollution effects, Jurisdiction, State governments, Water conservation, Water supply, Administration, Administrative agencies, Water quality, Water resources, Water ality control. Identifiers: Refuse Act.

Water pollution must be controlled if mankind is to have a future. Federal laws are required to solve the water pollution problem. A solution through state action is unlikely because: (1) pollution crosses political boundaries and under federal control there are fewer boundaries; (2) states cannot raise the funds to control pollution; and (3) states are competing for industry. Pollution control laws should include federal standards with provisions to facilitate their updating without lengthy legislative procedures. All existing agencies with environmen-tal jurisdiction should be eliminated, and they should be replaced by one super agency restricted to protecting our environment. In the area of en-forcement, future laws should include a minimum fine and a maximum fine that would act as a real deterrent. A percentage of net daily profit or effluent charges are suggested as a maximum fine. The fine must insure that it will be costlier to pollute than to prevent pollution. The Refuse Act is the finest existing federal legislation because it allows dissatisfied citizens to carry on litigation. Fines under existing federal statutes are set forth. A bibliography of relevant material is provided. (Horwitz-Florida) W72-01665

CLEAN WATERS FOR ALABAMA'S ESTUA-

For primary bibliographic entry see Field 05G. W72-01666

WATER POLLUTION CONTROL BY TANKER TRAFFIC CONTROL,

J. R. Rarick. Congressional Record, Vol 117, No 73, p H 4094 (daily ed. May 18, 1971). 1 p.

Descriptors: \*Navigation, \*Supervisory control, \*Safety, \*Water pollution control, Water pollution, Water pollution surces, Regulation, Political aspects, Legal aspects, Project planning, Administration, Oil, Oil industry, Oily water, Ships, Hazards, Accidents, Harbors.

Major oil spills due to tanker collisions and other mishaps constitute a significant portion of ocean pollution from oil spillage. The key to prevention of such tanker incidents lies in a precise traffic control plan governing all ship movements plus enforce-ment of specific regulations requiring sophisticated navigation equipment and practices along with high competence for personal in responsible positions. Strict standards for hull design and operating equipment are also needed. A ship's track and rements in coastal waters can be monitored and controlled from shore in the same manner as is done with aircraft. A tanker on entering a coastal area can be put into a specific traffic pattern. Shore control should monitor the ship and have absolute authority to determine whether the traffic conditions are suitable to permit it to enter or leave port. Such regulation is in conflict with some old traditions of the sea, but these traditions are obsolete and incompatible with the present level of sea transport and our desire to control pollution. W72-01667

LEGISLATION DEALING WITH ENVIRON-

MENT, T. F. Eagleton.

Congressional Record, Vol 116, No 5, p S 444-5 (daily ed. January 23, 1970). 2 p.

Descriptors: \*Political aspects, \*Project planning, \*Environment, \*Water pollution control, Water pollution, Air pollution, Water quality, Water quality control, Water conservation, Legal aspects, Federal government, Legislation, Waste disposal, Grants, Financing, Treatment facilities, Environ-mental effects, Industrial wastes, Research and development, Standards, Administration.

Senator Muskie is praised for his stand against environmental pollution, and a statement made by the Chairman of the Subcommittee on Air and Water Pollution is entered in the record. The statement points out the need for immediate forceful action by the federal government in all areas of environ-mental preservation. In the area of water quality, several amendments to the Federal Water Pollution Control Act are recommended, including: (1) authorizing \$2.5 billion in construction grants yearly for the next five years, (2) encouraging river basin development and financing treatment systems, (3) extension of the water quality standards are the standards. dards program to all navigable waters, (4) requiring all new industrial facilities using navigable waters to utilize the best pollution control technology, inclusion of enforceable effluent standards and compliance schedules in all water quality the standards and compliance schedules in all water quality the standards and compliance schedules in all water quality. plans, (5) tightening up federal enforcement, (6) greater public participation in developing water standards, and (7) requiring that federal water quality criteria be made available to the public. Senator Muskie also puts forth definite proposals in the areas of air quality, solid wastes, noise pollution, executive organization, marine resources, technical advancement and environmental research, and electrical power development. (Hor-W72-01668

ENVIRONMENTAL POLLUTION,

08 (daily ed. February 24, 1970). 3 p.

Waste Disposal Act.

House of Representatives, Washington, D.C. S. Gibbons. Congressional Record, Vol 116, No 25, p E1206-

Descriptors: \*Water pollution control, \*Water quality control, \*Government finance, \*Waste treatment, \*Legislation, Environmental sanitation, Solid wastes, Grants, Waste disposal, Treatment facilities, Construction costs, Water Quality Act, Standards, Administrative agencies, Navigable waters, Sewers, Estuaries, Oil wastes, Municipal wastes, Industrial wastes, Adjudication procedure, Conferences, Federal government. Identifiers: \*Clean Water Restoration Act, \*Solid

Existing laws and programs respecting water and air pollution and solid waste disposal are reviewed in this summary. The Federal Water Pollution Control Act is the main weapon to clean up America's waters. It provides for grants to cities to construct sewage treatment facilities, provides for enforcement measures, and provides for research programs. The Water Quality Act of 1965 is administered by the Federal Water Pollution Control Administration and establishes mandatory standards specifying quality criteria for interstate waters. The Clean Water Restoration Act of 1966 provides extensive funding for the construction costs for treatment facilities. It also provides for research and development grants, particularly for industrial waste treatment and joint municipal-in-dustrial waste treatment. Current bills providing enforcement measures and financial assistance for new areas of pollution control are discussed. There are three major components of standards: (1) designation of uses for waters, (2) specification of narrative and numerative criteria, and (3) specification of plans for implementation and enforcement. Enforcement measures include enforcement orders, public hearings, and court action. The Solid Waste Disposal Act of 1965, providing federal research, training programs, and grants for demonstration projects, is discussed. (Rees-qflorida) W72-01669

### Field 06-WATER RESOURCES PLANNING

#### Group 6E—Water Law and Institutions

POLLUTION: THE PLUNDERING OF OUR EN-VIRONMENT,

C. A. Vanik.

Congressional Record, Vol 116, No 38, p H 1766-67 (daily ed. March 12, 1970). 2 p.

Descriptors: "Water pollution control, "Political aspects, "Project planning, "Legislation, Pollution abatement, Air pollution, Legal aspects, Water conservation, Water quality, Water quality control, Federal government, Administration, State governments, Local governments, Jurisdiction, Waste disposal, Financing, Grants, Treatment facilities, Public health, Environment, Standards, Industrial wastes.

Past and present problems to be faced in this nation's efforts to control pollution are examined. One of the major difficulties has been the lack of effective action by state and local governments to carry out the duties of pollution control. Special at-tention is given the problems of Lake Erie as han-dled by the state of Ohio. The federal role in air and water pollution is briefly summarized, along with a description of instances where federal agencies been guilty of pollution. To combat this problem several solutions are put forth. First, the massive federal program to build new public waste treatment facilities must be matched with vigorous enforcement against municipal and industrial polluters. Secondly, to save Lake Erie, a water pollu-tion disaster fund must be established with 25% of all federal pollution control funds earmarked specifically to meet the problem of high-density interstate pollution. Strict standards and specifica-tions for industrial water use should be established. Finally, all other possible means to save the environment must be employed, including utilization of the tax system in the fight against pollution. W72-01671

OPINION OF THE JUSTICES (USE OF STATE BONDS TO FINANCE LOANS FOR CON-STRUCTION OF PRIVATE POLLUTION CON-TROL FACILITIES.

TROL FACILITIES).
1 Environmental L. Rep. 20253-20254 (Sup. Jud. Ct. Mass., March 23, 1971).

Descriptors: \*Massachusetts, \*Government finance, \*Treatment facilities, \*Industrial wastes, Judicial decisions, Legal aspects, State governments, Legislation, Water pollution control, Pollution abatement, Water pollution sources, Waste disposal, Waste treatment, Environmental sanitation, Sanitary engineering, Financing, Loans, Public benefits.

Identifiers: \*Constitutionality.

The Governor of Massachusetts sought the opinion of the Supreme judicial Court of Massachusetts on the consitutionality of a statute which authorized loans to private businesses for the construction of waste treatment facilities. The funds for the loans were to be raised by the sale of bonds. The Governor sought opinions on two questions. First, was the use of funds for loans to private individuals and organizations an expenditure of public funds for other than a public purpose. Secondly, was the issuance of bonds and the use of their proceeds for such loans a violation of the Constitution of the Commonwealth. The Court ruled that where an expenditure has both a public and private benefit, it should be classified according to its primary consequences. They found that the primary purpose of the statute, abatement of industrial water pollution, had a clear public benefit. The Court also ruled that the use of lands to finance the loans was the equivalent of a state guaranty of a loan to the ulti-mate borrower and violated the constitutional prohibition against the use of state credit to underwrite any private organization. (Johnson-W72-01672

THE CONSTITUTION, THE PUBLIC TRUST DOCTRINE, AND THE ENVIRONMENT, For primary bibliographic entry see Field 05G. W72-01673

WATERS AND WATERCOURSES--RIGHTS OF THE PUBLIC IN NONNAVIGABLE WATERS, R. T. Phillips.

Mississippi Law Journal, Vol 42, No 2, p 270-276, Spring, 1971. 7 p, 54 ref.

Descriptors: \*Mississippi, \*Navigable waters, \*Non-navigable waters, \*Public rights, Judicial decisions, Legal aspects, Navigation, Ownership of beds, Riparian rights, Streambeds, Non-consumptive use, Transportation, Prior appropriation, Public benefits, Inland waterways, Streams, Rivers, Navigable rivers, Water users, Watercourses (Legal), Natural streams.

In a recent decision, Downes v. Crosby Chemicals, Inc., the Mississippi supreme court held that a creek was non-navigable, and therefore was not a public stream. The action was brought by the streambed owner, to cancel defendant's assertion that the stream was public, and to enjoin further trespass. The navigability test used by the Mississip pi court ignores a recent trend toward utilization of a recreational usage test to determine public ownership. Two problems prevail in using the navigability test to determine public ownership: (1) is navigability the best test to protect the relative rights of the streambed owner and the public, while achieving maximum utilization of natural water resources; and (2) what test of navigability should be applied. The earlier tests of navigability were based on use of the waters for commercial trans-portation. A streambed owner, however, does not own the water over the bed; paradoxically the public cannot use the waters which it owns where the navigability test is used. Suitability for public use would provide a better test of public ownership. In the Downes decision, the Mississippi court refused to utilize the expanding recognition of public rights in waterways. W72-01674

POWERS OF STATE UNDER ORDINANCE OF 1787 IN RESPECT OF NAVIGABLE WATERS.

American Law Reports, Annotated, Vol 54, p 438-448, 1928. 11 p.

Descriptors: \*Legislation, \*Navigable waters, \*Mississippi River, \*St. Lawrence River, \*Federal-state water rights conflicts, Navigable rivers, Rivers, Streams, State governments, Bridges, Docks, Dams, Locks, Federal government, United States, Indiana, Michigan, Minnesota, Ohio, Wisconsin, Iowa. Identifiers: \*Ferries.

Concerning the Northwest Territory, the Congressional Ordinance of 1787 provided that 'navigable waters leading into the Mississippi and St. Lawrence ... shall be common highways, and for-ever free ... without any tax, import, or duty .' Cases dealing with the powers of the states under this Ordinance are the subject of this annotation. The purpose of the Ordinance was to preserve the natural character of all rivers leading into the Mississippi and St. Lawrence and to prevent monopolistic utilizations of their waters. After admission of the states within the Northwest Territory, the Ordinance remained in full force and effect. It has been held inapplicable to penultimate tributaries of the named rivers. It is only applicable to streams which were common highways for canoes. utilized for commerce, or otherwise embraced by the definition of 'navigable waters'. State improve ments and obstructions, such as ferries, bridges, wharves, or dam and locks which do not substantially obstruct navigation are permissible. Moreover, the Ordinance does not prohibit states from exacting tolls for the use of these benefits to navigation and commerce. (Hart-Florida) W72-01676

#### OIL AND GAS PRODUCTION.

Missouri Ann Stat secs 259.010, 259.050 thru 259.070 (Supp 1971).

Descriptors: \*Missouri, \*Oil fields, \*Water pollution control, \*Administrative agencies, Water pollution sources, Oil wells, Legislation, Regulation, Water law, Legal aspects, Oil, Natural gas, Oil industry, Oil wastes, Environmental engineering, Performance, Supervisory control (Power), Waste water.

The State Oil and Gas Council is herein established and granted certain powers and duties. The Missouri Water Pollution Board is made a member of the Council. The principal purpose of this chapter is to provide the Council with the necessary powers to enforce the statutory prohibition against the waste of oil and gas. The definition of 'well' includes any hole drilled in the earth for or in connection with the disposal of salt water, nonusuable gas, or other waste accompanying the production of oil or gas. The Council has the authority to require the drilling, casing, operation, and plugging of wells in such a manner as to prevent the pollution of fresh water supplies by oil, gas, or highly mineralized water. It also has authority to regulate the disposal of highly mineralized water and oil field wastes. It is empowered to make rules, regulations, or orders for the classification of wells as wells for the disposal of highly mineralized water, brine, or other oil field wastes. A further power of the Council is to fix water-oil ratios for efficient well operations. (Johnson-Florida) W72-01677

WHO'S MR. CLEAN.
For primary bibliographic entry see Field 05G.
W72-01678

TAPPING AN OLD LAW TO CATCH POLLUTERS.
For primary bibliographic entry see Field 05G.
W72-01679

THE 1899 REFUSE ACT,

United States Senate.

J. C. Boggs. 117 Cong Rec 844-855 (daily ed February 4, 1971). 12 p.

Descriptors: \*Permits, \*Water pollution control, \*Navigable waters, \*Rivers and Harbors Act, Administration, Water pollution, Water pollution sources, Water pollution effects, Legal aspects, Political aspects, Regulation, Federal governments, State governments, Jurisdiction, Administrative agencies, Damages, Remedies, Legislation, Standards, Inspection, Treatment facilities, Waste disposal.

Identifiers: \*Refuse Act.

The Refuse Act of 1899 is analyzed through a consideration of material relating to proposed policy, practice, and procedures under the new federal permit program. The processing permits and the coordination between the Corps, the Environmental Protection Agency, and other federal agencies are considered. Special attention is given to such procedures as: (1) the information required on permit applications, (2) the consequences of state certifications, (3) the processing of permit applications, (4) the giving of public notice and public hearings, (5) the issuing of environmental impact statements, (6) the publicity to be given applications; and (7) the duration of permits. The memorandum of understanding between the Administrator of the Environmental Protection Agency and the Secretary of the Army concerning operations under the Refuse Act is reprinted. The effect of state certification of activities requiring a federal license or permit is dealt with in an Environmental Protection Agency order. Finally, the overall effectiveness of the permit program is considered by the General Council of the Council on Environmental Quality. Questions put to the Agency are reprinted. (Horwitz-Florida)

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Descript mental s

## A BILL TO REGULATE THE DISCHARGE OF WASTES IN TERRITORIAL AND INTERNA-TIONAL WATERS.

Senate, Washington, D.C.

Congressional Record, Vol 117, No 26, p S 2257-58 (daily ed. March 2, 1971). 2 p.

Descriptors: \*Waste disposal, \*Oceans, \*Great Lakes, \*Water pollution control, \*Pollution abatement, \*Legislation, International waters, Continental shelf, Water pollution, Pollutants, Water quality, Water quality control, Environmental sanita-tion, Federal government, Legal aspects, Wastes, Continental margin, Coasts, Regulation, Govern-ment finance, Research and development.

A massive increase in the level of wastes dumped A massive increase in the level of wastes dumped into our oceans and the Great Lakes threatens environmental deterioration. To New Jersey and neighboring states it is more than a threat. Beaches are beginning to show the effect of offshore dump ing, but the major effect has been fish and seafood population reductions. In response to the problems caused by the discharge of wastes in territorial and international waters, a bill introduced by Senator Case would regulate such discharges for five years, prohibit such discharges thereafter, and authorize research and demonstration projects to determine means of using and disposing of such wastes. During the first five years wastes could only be dumped beyond the continental shelf. Financial assistance could be provided by the Environmental Protection Agency to assist research in this area. Specific examples of the effects of ocean dumping on New York and New Jersey are cited. (Robinson-W72-01681

#### LEGISLATION TO END INDISCRIMINATE OCEAN DUMPING,

C. W. Sandman. Congressional Record, Vol. 117, No. 1, p. E41-3 (daily ed., January 21, 1971). 3 p.

Descriptors: \*Permits, \*Waste disposal, \*Oceans, \*Water pollution control, Legal aspects, Public health, Project planning, Water pollution sources, Federal government, Jurisdiction, Legislation, Administration, Administrative agencies, Sea water, Environment, Environmental effects, Waste dumps.

Realizing the present and future danger to the environment from ocean pollution, Congressman Charles H. Sandman introduced a bill to control ocean dumping. The bill establishes direct controls over dumping within the 3 mile territorial limit, and beyond the jurisdictional limit through controls over loading in any United States port of waste material for ocean dumping. No owner or master of a vessel may load or permit the loading of any waste on such vessel while in port, if such waste is to be discharged in ocean waters, unless the owner or master follows certain requirements. First, a permit must be obtained from the Administrator of the Environmental Protection Agency. This permit must authorize the loading of such waste and may prescribe an authorized ocean dumping site. The Administrator is also empowered to deny the disposal of waste that would be damaging to the marine environment or to human health and welfare. The owner or master must also notify the Coast Guard of such loading and dumping so the Coast Guard may conduct surveillance of the operations. The bill establishes penalties for viola-W72-01682

## MESSAGE FROM THE PRESIDENT OF EN-VIRONMENTAL QUALITY,

Senate, Washington, D. C. R. M. Nixon.

Congressional Record, Vol 116, No 18, p \$1604-14 (daily ed. February 10, 1970). 11 p.

Descriptors: \*Water pollution control, \*Environmental sanitation, \*Solid wastes, \*Parks, Air pollu-

tion, Water resources development, Land reclama tion, Land use, Water pollution sources, Municipal wastes, Industrial wastes, Farm wastes, Treatment facilities, Waste treatment, Standards, Legislation, Government finance, Grants, Administrative agencies, Regulation, Real property, River basins,

The President herein proposes a comprehensive program embracing major legislative proposals and new measures being executed under administrative action in five major categories: (1) water pollution control, (2) air pollution control, (3) solid waste management, (4) parklands and public recreation, and (5) organizing for action. Municipal and industrial wastes are the primary contributers to water pollution. New measures would implement design and operation standards for treatment facilities, im-pose water user fees, establish effluent require-ments, provide regional planning and special consideration for river basins, and utilize more injunctive relief and other judicial procedures to abate pollution. Air pollution results primarily from automobiles and stationary sources such as power-plants and incinerators. New measures would establish testing programs for auto fuel emissions and implement a national air quality standards program. Solid waste management would require research to make products more disposable and programs to reuse and recycle products. To guarantee adequate parklands and public recrea-tion areas, the new measures would allocate funds through the Land and Water Conservation Fund to purchase more property and would review existing uses of federal lands. Committees to organize these programs are discussed. (Rees-Florida) W72-01683

## A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL ACT TO STRENGTHEN AND IMPROVE AUTHORITY TO ENFORCE ABATEMENT OF POLLUTION, TO PROVIDE FOR FILING OF NOTICE WITH RESPECT TO DISCHARGE OF MATTER INTO INTERSTATE OR N AVIGABLE WATERS AND TO REQUIRE PERMITS TO REGULATE SUCH DISCHARGE OF MATTER.

House Bill 14456, 89th Cong, 2d Sess. (1966). 11 p

Descriptors: \*Water pollution control, \*Navigable waters, Permits, "Legislation, Water law, Adjudication procedure, Administrative agencies, Interstate rivers, State governments, United States, Foreign governments, Pollution abatement, Inspection, Surveys, Conferences, Standards, Water quality control, Pollutants, Waste disposal, Remedies, Damages, Public health, Interstate com-

Identifiers: \*Federal Water Pollution Control Act.

This bill would amend sections 10 and 11 of the Federal Water Pollution Control Act to increase the authority of the Secretary of the Interior to: (1) notify formally and request the pollution control agency of a state discharging pollutants into interstate or navigable waters to attend a conference with other states adversely affected: (2) call a conference whenever reports and surveys indicate discharges are causing water pollution or there is substantial economic injury to the shellfish industry from discharges or the actions of federal, state, and local authorities: (3) call a conference whenever a foreign country is endangered by a state's pollution and to request that country's presence at the conference; (4) request the Attorney General to seek appropriate judicial relief to abate pollution; (5) compel the presence and testimony of witnesses and the production of evidence; (6) conduct hearings and upon the inaction of the polluter request the Attorney General to initiate enforce-ment proceedings; (7) require persons to notify the Secretary about the location, nature, and quantity of discharges; (8) issue, deny, and revoke permits; and (9) enter property to inspect and investigate disposal systems. A new section would provide the district courts with regional jurisdiction to enjoin pollution on interstate and navigable waters. (Rees-Florida) W72-01684

THE DETERGENT POLLUTION CONTROL ACT OF 1970, Senate, Washington, D. C.

G. Nelson. Congressional Record, Vol 116, No 27, p \$ 2444-47 (daily ed February 26, 1970). 4 p.

Descriptors: \*Water pollution control, \*Phosphates, \*Detergents, \*Legislation, Chemicals, Chemical wastes, Cleaning, Domestic wastes, Eutrophication, Water pollution, Water pollution sources, Water pollution treatment, Nutrients, Oxygen requirements, Aging (Biological), Aquatic algae, Waste assimilative capacity, Water pollution effects, Pollutants, Pollution abatement, Federal government. Identifiers: \*Water Pollution Control Act.

Legislation to ban polyhosphates from detergents in the United States is necessary to halt water pollu-tion. The detergent industry has shown no intention of correcting phosphate pollution without legisla-tion. The Detergent Pollution Control Act of 1970, which would amend the Federal Water Pollution Control Act, requires the elimination of polyhosphates in detergents and the establishment of national environmental standards on detergent ingredients. Detergents are not controlled sewage treatment because phosphates pass through most treatment systems. Once entering lakes and rivers, phosphates excessively entich them with nutrients. This causes excessive algae growth and eutrophication. Several non-pollution phosphate substitutes which are feasible for use in industrial and household detergents have been developed. Enzymes are another pollutant used in most household detergents. The proposed Act makes it unlawful to manufacture detergents with phosphate after June 30, 1972. It also directs the establishment of standards of toxicity, ability, and biodegradability for all detergents. A federal assistance program would be used to accelerate the development of effective phosphate substitutes. (Hart-Florida) W72-01685

#### INTRODUCTION OF BILLS ON ENVIRON-MENTAL CONTROL, Senate, Washington, D. C.

Congressional Record, Vol 116, No 21, p \$1859-60 (daily ed February 18, 1970), 2 p.

Descriptors: \*Water pollution control, \*Financing, \*Legislation, \*Federal government, Political aspects, Project planning, Legal aspects, State governments, Local governments, Jurisdiction, Air pollution, Water pollution, Water quality, Grants, Treatment facilities, Water pollution effects, Waste disposal, Solid wastes, Participating funds, Research and development.
Identifiers: \*Water Pollution Control Act.

Senator Scott herein introduces a package of seven bills proposed by President Nixon to solve the Na-tion's pollution problems. The first bill amends the Federal Water Pollution Control Act to provide \$4 billion in federal funds for the construction of waste treatment plants during the next four years.

During this same period the bill proposes that local governments contribute another \$6 billion. A second bill is designed to assure that adequate financing will be available for state and local governments to participate in the program. The President is proposing the establishment of an En-vironmental Financing Authority which will obtain funds for local governments in the capital market. Two companion bills will privide swift, effective enforcement of pollution control measures and will insure pollution control research. Another bill will provide stringent automobile pollution controls and will authorize the Secretary of Health, Education, and Welfare to establish standards governing the composition of fuel and fuel additives. The final bill of the President's package will provide for in-vestigation and research into ways of dealing with solid wastes. (Horwitz-Florida) W72-01686

#### Field 06-WATER RESOURCES PLANNING

#### Group 6E—Water Law and Institutions

WATER POLLUTION PROBLEMS IN CEN-TRAL NEW YORK, House of Representatives, Washington, D. C.

J. M. Hanley.

Congressional Record, Vol 116, No 33, p H 1574 (daily ed March 5, 1970). 1 p.

Descriptors: \*Water pollution control, \*Participating funds, \*Grants, \*Financing, Project planning, State governments, Federal governments, Local governments, Legal aspects, Political aspects, Jurisdiction, Water pollution, Pollution abatement, Treatment facilities, Public health, Waste disposal.

Water pollution problems of central New York are herein considered with special attention focused upon the Onondaga County Pollution Control Project. This program received a \$350,000 federal study grant, in 1966, to conduct research into a program to abate and control the area's water pollution. Recently the County submitted an application for a \$50 million project to substantially expand and upgrade waste treatment. This project is an outgrowth of the federal study grant and is eligi-ble for a 55% federal grant. The balance would be obtained from 30% state financing and 15% local financing. Due to the federal government's failure to privide enough funds for water pollution control, it is unlikely that anything near the promised 55% will be provided. Since New York will only finance 30% of the costs, localities such as Onondaga County, are forced with the heavy burden of providing 40% of needed project funds. This is unsatisfactory and should be corrected through in-creased federal funding for all local projects. Federal dollars going into water pollution will have to be doubled. Unless New York's share of federal funds is increased, its citizens must bear more costs than citizens in less progressive states. (Horwitz-W72-01687

INTRODUCTION OF A BILL ENTITLED NATIONAL WATER QUALITY STANDARDS ACT OF 1970, Senate, Washington, D. C.

E. S. Muskie.

Congressional Record, Vol 116, No 54, p 5167-70

(daily ed April 7, 1970). 4 p. Identifiers: \*Water quality control, \*Standards, \*Government finance, \*Waste treatment, State governments, Federal government, Water pollution control, Administrative agencies, Grants, Rural areas, River basins, Treatment facilities, Construction costs, Navigable waters, Tributaries, Judicial decisions, Adjudication procedure, Regulation, Permits, Contracts, Remedies, Fish, Wildlife, Pollution abatement, Conferences

An increase in the amount of state assistance grants to water pollution control agencies to \$20 billion annually is herein proposed. Waste treatment con-struction grants would be increased annually to \$2.5 billion. If fully funded, this authorization would generate the construction of \$25 billion worth of municipal waste treatment works. Special provision to allocate the first \$100 million annually to rural areas is retained. Provision to increase river basin planning is also included. Water quality standards are designed to protect and enhance existing quality of waters and require the inclusion of effluent requirements. Compliance schedules and revision procedures are included. Enforcement by the Secretary includes the use of orders of abate ment, public hearings and review procedures, and judicial proceedings in federal district court. Violators could be punished by fines up to \$25,000 daily or a year of imprisonment or both. Protection for employees who volunteer information proceedings under the Bill is provided, including rehiring or reinstatement following an illegal discharge. The Secretary of Interior would be authorized to bring suit whenever an effluent source presents a danger to fish or economic injury to the shellfish market. (Rees-Florida) W72-01688

INTRODUCTION OF NATIONAL LEAGUE OF CITIES WATER POLLUTION BILL, Senate, Washington, D. C.

E.S. Muskie.

Congressional Record, Vol 116, No 54, p S5170-71 (daily ed. April 7, 1970). 2 p.

Descriptors: \*Water pollution control, \*Grants, \*Treatment facilities, \*Federal government, Project planning, Water pollution, Water quality, Pollution abatement, Water quality control, Water pollution sources, Water pollution effects, State governments, Local governments, Jurisdiction, Financian, Water disease, Language, Legisla. Financing, Waste disposal, Legal aspects, Legislation, Public health. Identifiers: \*Water Pollution Control Act.

The Clean Water Commitment Act of 1970 is intended to provide a national commitment for the financing of expanding programs under the Federal Water Pollution Control Act and to assure coor-Water Pollution Control Act and to assure coordination in the development of local clean water programs. Continued population growth and economic expansion require high quality water supplies. The Nation's waterways are currently in serious danger of becoming polluted to a degree that will be injurious to public health and welfare. The urgency of this problem requires the dedication of substantial public and private resources to control and abate water pollution. This will require a firm commitment of \$20 billion in federal expenditures during the next decade. These poals are to ditures during the next decade. These goals are to be achieved through coordination with state and local governments who shall establish water basin commissions to develop comprehensive water quality control plans. In addition to the \$20 billion in grants for treatment facilities, the bill provides \$25 million annually, through 1976, to aid in the prevention and control of pollution. Federal grants may comprise up to 50% of project costs. Cor-respondence to Senator Muskie from the National Leagues of Cities and the President is set forth. (Horwitz-Florida) W72-01689

ENVIRONMENTAL INTRODUCTION OF QUALITY ADMINISTRATION ACT OF 1970,

enate, Washington, D. C.

E. S. Muskie. Congressional Record, Vol 116, No 53, p S5115-18 (daily ed April 6, 1970). 4 p.

Descriptors: \*Federal government, \*Administra-tive agencies, \*Pollution abatement, \*Water pollu-tion control, \*Institutional constraints, Air pollution, Administration, Administrative decisions, Regulation, Water pollution, Non-structural alternatives, Governments, Government finance, Legislation, Legal aspects, Inter-agency coopera-

The federal 'war' against pollution is being fought with ineffectiveness and inefficiency because of an inadequate organization of the administrative agencies charged with enforcement of federal pollution laws. Therefore, the Environmental Quality Administration Act of 1970 is introduced to reorganize the executive branch. It would remove the overlap of responsibility between various agencies by consolidating the agencies and activities in the Environmental Quality Administration. The function of eleven agencies would be transferred to the Administration: (1) the National Air Pollution Control Administration; (2) the Bureau of Radiological Health; (3) the Bureau of Solid Waste Management; (4) the Bureau of Water Hygiene; (5) the Environmental Science Services Administration; (6) the Federal Water Pollution Control Administration; (7) the Water Resources Division, Geological Survey; (8) the water and sewers facilities division, Farmers Home Administration; (9) the Pesticide Control Board; (10) the water and sewer grant program, Community Development Administration; and (11) the Office of Noise Abatement, Department of Transportation. The new Administration must be supported with a com-mittment in money and manpower to perform the assigned task. Proposed objectives and duties of the Administration are set forth. (Hart-Florida)

W72-01690

#### **6F. Nonstructural Alternatives**

FLOOD PLAIN INFORMATION, SANTA CRUZ RIVER (STATE HIGHWAY 82 TO INTERNA-TIONAL BOUNDARY), SANTA CRUZ, ARIZONA.

Army Engineer District, Los Angeles, Calif. For primary bibliographic entry see Field 04A. W72-01156

FLOOD PLAIN INFORMATION, FARMINGTON AND CONNECTICUT RIVERS, WINDSOR, CONNECTICUT. Army Engineer District, Waltham, Mass.

For primary bibliographic entry see Field 04A. W72-01157

SPECIAL FLOOD HAZARD INFORMATION REPORT, HOBOLOCHITTO CREEK, EAST AND WEST HOBOLOCHITTO CREEKS, PICAYUNE, PEARL RIVER CO., MISSISSIPPI. Corps of Engineers, Mobile, Ala. For primary bibliographic entry see Field 04A. W72-01377

FLOOD PLAIN INFORMATION, WEST BRANCH ROCKY RIVER, CUYAHOGA AND LORAIN COUNTIES, OHIO. Corps of Engineers, Buffalo, N.Y. For primary bibliographic entry see Field 04A. W72-01378

WOOD V. TOWN OF LEWISPORT (ADJOIN-ING LANDOWNER'S CLAIM OF TITLE TO RIPARIAN LAND DEDICATED TO PUBLIC USE).

For primary bibliographic entry see Field 06E. W72-01428

WISCONSIN'S REQUIREMENTS FOR SHORE-LAND AND FLOOD PLAIN PROTECTION, Donald F. Wood.

Natural Resources Journal, Vol 10, No 2, p 327-338 (1970). 12 p, 10 ref.

Descriptors: \*Wisconsin, \*Flood plain zoning, \*Shores, \*Land use, Zoning, State governments, Local governments, Administrative agencies, Nonstructural alternatives, Shoreline cover, resources, Water resources development, Shore protection, Planning, River basin development, Project planning, Flood plains, Flood protection, Water zoning, Legislation, Legal aspects.

Wisconsin legislation requires local governments to enact zoning requirements for flood plains and shorelands within their respective jurisdictions. Failure to enact local ordinances would result in radiute to enact tocal ordinances would result in enactment by the state government. This article reviews the efficacy of this new legislation. The shoreland regulations are primarily for environ-mental protection, while the flood plain law at-tempts to minimize flood damage. The relationship of shoreland and flood plain zoning to water resource planning and to land-use planning is considered first. It is emphasized that flood plain zoning is generally applicable to rivers and streams, whereas shorelands regulations apply mainly to lakes. The difficulty of achieving adequate shoreland and flood plain zoning without a comprehen-sive land-use plan is discussed. A primary purpose of the new zoning powers is to preserve wetlands. Doubt is expressed as to the efficacy of protecting single parcels of wetlands through zoning. The effectiveness of zoning is analyzed. The author concludes that the new program will result in better development of waterfront areas. Unsolved problems, such as shoreline cover, land slope at the shore, water pollution, and definition of jurisdictions, are also discussed. (Hart-Florida) 6G. E Wat

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#### 6G. Ecologic Impact of Water Development

CONSERVATION OF NATURAL RESOURCES, For primary bibliographic entry see Field 05G. W72-01270

ON MAN AND HIS ENVIRONMENT, For primary bibliographic entry see Field 06B. W72-01563

11TH TECH MEETING OF THE INTERNAT'L UNION FOR NATURE CONSERVATION AND NATURAL RESOURCES, 1ST AND 2ND SESSIONS. COMMISSION ON ECOLOGY SECTION ON CONSERVATION IN LAND USE PLANNING, SOIL AND H2O RESOURCES, ESPECIALLY IN MT REGIONS, WILDLIFE RESOURCES, AND FORESTRY. NEW-DELHI, INDIA, NOVEMBER 25-28, 1970, For primary bibliographic entry see Field 04A.

For primary bibliographic entry see Field 04A. W72-01596

11TH TECH MEETING OF THE INTERNAT'L UNION FOR NATURE CONSERVATION AND NATURAL RESOURCES, 1ST AND 2ND SESIONS. COMMISSION ON ECOLOGY SECTION ON EFFECTS OF POLLUTION ON NATURAL ECOSYSTEMS. NEW-DELHI, INDIA, NOVEM BER 15-28, 1969,

For primary bibliographic entry see Field 05C. W72-01599

11TH TECH MEETING OF THE INTERNAT'L UNION FOR NATURE CONSERVATION AND NATURAL RESOURCES, 1ST AND 2ND SES-SIONS. COMMISSION ON ECOLOGY SECTION ON THE INTERNAT'L BIOLOGICAL PRO-GRAM CURRENT RESEARCH IN INDIA, AND ITS R ELEVANCE TO CONSERVATION. NEW--DELHI, INDIA, NOV. 25-28, 1969, INDIA, NOV.

25-28, 1970, For primary bibliographic entry see Field 02H. W72-01603

#### 07. RESOURCES DATA

#### 7B. Data Acquisition

EVALUATION OF SNOW WATER EQUIL-VALENT BY AIRBORNE MEASUREMENT OF PASSIVE TERRESTRIAL GAMMA RADIA-TION,

National Weather Service, Silver Spring, Md. E. L. Peck, V. C. Bissel, E. B.Jones, and D. L.

Burge. Water Resources Research, Vol 7, No 5, p 1151-1159, October 1971. 7 fig, 2 tab, 7 ref.

Descriptors: \*Snow surveys, \*Remote sensing, \*Gamma rays, \*Snowpacks, \*Water equivalent, Nuclear moisture meters, Telemetry, Snow, Snow

cover, Instrumentation. Identifiers: Passive terrestrial gamma radiation.

An airborne gamma radiation detection system determines the water equivalent of snowpacks in nonmountainous areas. Snow attenuates natural gamma emissions from the soil, and the magnitude of attenuation is related to the mass of the water blanket between the soil and the detector. Gamma spectral and total counting rates are collected and recorded by an airborne system using fourteen 4-by 4-inch sodium iodide (NaI (T1)) crystals. These data are corrected for soil moisture, background radiation, and effects of air density. Extensive snow radiation, and effects of air density. Extensive snow depth and density measurements were taken to determine 'ground truth' water equivalent under the flight path. Gamma spectral data give a real measurement of snow water equivalent within at least 0.2-0.5 inch over favorable terrain. The use of total count data is even more promising but

requires the background interference. (Knapp-USGS) W72-01125

AN ECONOMICAL DEVICE FOR OPTICALLY DETECTING SNOW DEPTH AT REMOTE STA-

Utah State Univ., Logan. Dept. of Soil Science and Biometeorology.

For primary bibliographic entry see Field 02C. W72-01139

ANALYSIS OF ALPINE WATERS BY ION ELECTRODE METHODS,

Dartmouth College, Hanover, N. H. Dept. of Earth

For primary bibliographic entry see Field 02K. W72-01141

APPLICATION OF THERMOCOUPLE PSYCHROMETERS TO SOIL WATER TRANS-PORT,

Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs. For primary bibliographic entry see Field 02G.

SIMPLE PUMPING SAMPLER FOR RESEARCH INTO SUSPENDED SEDIMENT TRANSPORT IN SMALL CATCHMENTS,

W72-01144

Exeter Univ. (England). Dept. of Geography For primary bibliographic entry see Field 02J. W72-01148

ELECTRON MICROSCOPY APPLIED TO QUARTZ GRAINS FROM A TROPICAL EN-VIRONMENT.

Nottingham Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 02J. W72-01151

ANALYSIS OF GROUND-WATER SYSTEM IN ORANGE COUNTY, CALIFORNIA, BY USE OF AN ELECTRICAL ANALOG MODEL, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 02F. W72-01155

SOIL MOISTURE MEASUREMENT BY THE CAPACITANCE METHOD (O IZMERENII VEMKOSTNYM VLAZHNOSTI POCHVY

WETODOM), Relorusskii Nauchno-Issledovatelskii Melioratsii i Vodnogo Khozyaistva, Minsk (USSR). For primary bibliographic entry see Field 02G. W72-01169

METHOD OF DETERMINING THE SOIL MOISTURE POTENTIAL WITH A PRESSURE MEMBRANE APPARATUS (K METODIKE OPREDELENIYA POTENTSIALA VLAZH-NOSTI POCHV S PRIMENENIYEM MEMBRAN-NYKH PRESSOV), Vsesoyuznaya Akademiya Selskokhozyaistvennykh

Nauk, Moscow (USSR). Agrofizicheskii Nauchno-Issledovatelskii Institut.
For primary bibliographic entry see Field 02G.

W72-01171

MOVEMENT DETERMINATION OF THE ROSS ICE SHELF, ANTARCTICA, New Brunswick Univ., Fredericton. Dept. of Sur-

veying Engineering. For primary bibliographic entry see Field 02C. W72-01187

PORTABLE RAINFALL SIMULATOR AND PLOT UNIT FOR USE IN FIELD STUDIES OF INFILTRATION, RUNOFF AND EROSION, Commonwealth Scientific and Industrial Research

Organization, Canberra (Australia). Div. of Plant Industry.

A. B. Costin, and D. A. Gilmour.

Appl Ecol. 7 (1): 193-200 Illus 1970. Identifiers: Erosion, Field, Infiltration, Plot, Porta-ble, Rainfall, Runoff, Simulator, Unit.

The equipment can be rapidly assembled and operated. The 10 x 6 ft plots are enclosed by a mild-steel top, jointed side-sections, and an angleiron collecting drain with an outlet leading to a container of suitable size. Simulated rainfall is supplied to the plot from drums of water by means of a mobile engine-driven centrifugal pump fitted with a bypass valve. The rain is directed on to the plot bypass vaive. The rain is directed on to the plot with a hand-operated boom and nozzle from which the amount and intensity of the rainfall are controlled. This equipment delivers simulated rain with drop size, intensity, and a terminal velocity which are generally similar to those found for comparable natural storms. Some field applications are described.—Copyright 1971, Biological Abstracts, Inc. Inc. W72-01237

SOIL MOISTURE DETECTION WITH IMAGING RADARS,

Georgia Southern Coll., Statesboro. Harold C. MacDonald, and William P. Waite. Water Resources Research 7 (1): 100-110. Illus. Map. 1971.

Identifiers: Aerial, Detection, Imaging, Moisture, Photography, Radars, Soil, Supplement.

The high degree of correlation between the electrical properties of soil and soil moisture content are well-known. Considerable experimental work was conducted by using radar for the determination of soil moisture. However, in the transition from a controlled measurement device to an operational imaging radar, the effects of soil moisture were extremely difficult to separate from other terrain parameters influencing the radar return signal. Presently available dual polarized, K-band, sidelooking imaging radars provide a capability for revealing a qualitative estimate of soil moisture content. When used as a supplement to aerial photography in temperate climates, radar imagery analysis will decrease the ambiguity of soil type reconnaissance. In the Arctic, an imaging radar may provide data for mapping regions of per-mafrost, and this process could be accomplished in a sequential manner regardless of weather or time of day. The use of additional multifrequency mul-tipolarization imaging radars and the relative foliage penetration of each should be investigated as a possible means of gathering quantitative soil moisture information.—Copyright 1971, Biological Abstracts, Inc. W72-01242

A METHOD OF CONTINUOUS WATER CON-TENT MEASUREMENTS IN LEAVES BY MEANS OF BETA-RADIATION ABSORPTION. (IN GERMAN),

Wuerzburg, Univ. (West Germany). Botanisches

Uwe Buschborn

Planta. 95 (2): 146-166. Illus. 1970. English sum-

Identifiers: Absorption, Auto, Beta, Counter, Electronic, Gauge, Geiger, Leaves, Measurements, Method, Muller, Radiation, Radiography, Scaler, System, Timer.

A brief introduction to the beta-ray gauging technique is given with its application in determining the water content of leaves. Some aspects for the choice of the radioactive isotope, the dector and the recording system are discussed in respect to their utilization and precision. A short review of the instrumentation is given. The construction of a complete ray gauge is described Kr.85 (Fmax.) new beta-ray gauge is described. Kr-85 (Emax -

#### Field 07—RESOURCES DATA

#### Group 7B—Data Acquisition

0.67 meq) with an activity of 0.35 mc served as the radiation source (active diameter - 1 mm). This point-shaped and relatively energy-rich beta-ray source permits a working distance between source and detector of several cm and allows within certain limits a choice of test surface area. A halogenquenched Geiger-Mueller-counter with a window of 2 cm diameter and 1.5-2.0 mg/sq cm was used. In the construction of the measuring set-up special attention was paid to the reproducibility of the geometry between source, sample and detector. The impulses which reach the detector were recorded by an electronic scaler-timer system. Count rate measurements were taken at various distances between emitter, absorber and detector. Furthermore the dependence of beta-ray absorption on the nature of the sample was examine Comparative measurements were made with homogeneous materials (aluminum foils, plastic sheets and filter paper) and heterogeneous materials (leaves with varying anatomical structure). Large differences were found between the amounts of beta-radiation absorbed by the same weights per unit area of these materials. These differences are discussed. A calibration method is described which allows an accurate determination of the dependence of count rate on water content of the tested leaf area after the experiment. A difference in weight per unit surface area of 0.1 mg/sq cm can be exactly determined. Leaves of the same species were examined under natural conditions in the habitat of the plants. With these continuous measurements of beta-radiation absorption great daily fluctuations in leaf water content were found ac-cording to the special weather conditions.--Copy-right 1971, Biological Abstracts, Inc. W72-01264

COMPARISON OF TWO FIELD TECHNIQUES FOR DETERMINATION OF WATER POTENTIAL IN TWO HALOPHYTES,

Urbana Coll., Ohio. James K. Detling, and Lionel G. Klikoff. Amer Medland Natur. 85 (1): 235-238. 1971. Identifiers: Determination, Field, Halophytes, Potential, Sarcobatus-Vermiculatus-D, Suaeda-Fruticosa-D, Techniques.

Results obtained by the dye and pressure-bomb techniques for field estimation of plant water potential were compared. No significant differences were found in the 2 methods over a wide range of water potentials in 2 spp of halophytes (Sarcobatus vermiculatus, Suaeda fruticosal).--Copyright 1971, Biological Abstracts, Inc. W72-01308

A TIPPING BUCKET RECORDER FOR USE IN

A TIPPING BUCKET RECORDER FOR USE IN STEM FLOW STUDIES,
Nature Conservancy, Orange-over-Sands (England). Merlewood Research Station.
E. J. White, and P. S. Rhodes.
J Appl Ecol. 7 (2): 349-352. Illus. 1970. Identifiers: Bucket, Flow, Recorder, Stem, Tipping.

A tipping-bucket water recorder is described which is particularly suitable for stem flow studies because of its large capacity buckets (100 ml), compared with those of tipping-bucket rain recorders.--Copyright 1971, Biological Abstracts, Inc. W72-01317

THE U S A CRREL DRILL FOR THERMAL CORING IN ICE, H. T. Ueda, and D. E. Garfield.

Journal of Glaciology, Vol 8, No 53, p 311-314, June 1969. 2 fig. 8 ref.

Descriptors: \*Core drilling, \*Ice, \*Drilling equipment, Cores, Drilling, Equipment, Instrumentation, Glaciers, Sampling, Melting, Drill holes. Identifiers: Thermal drill (Coring), Ice drills.

The USA CRREL drill is an 80-kg, electrothermal unit designed for continuous coring in temperate or polar ice or snow. The drill melts a hole approximately 16.3 cm in diameter and retrieves a core approximately 12.2 cm in diameter at rates from 1.9 meters per hr in -28 deg C ice to 2.3 meters per hr in temperate ice. The melt water formed is removed by a vacuum system and stored in a tank. Additional equipment includes 450 m of armored electrical cable, a hoist, a 6.7 m tower and a gasoline generator. The minimum time required to drill a 450-m hole is 435 hr. All of the equipment two men and has a gross shipping weight of 1180 kg. (Knapp-USGS) W72-01388 has been designed to be assembled and operated by

BUOYANCE-STABILIZED HOT-POINT DRILL FOR GLACIER STUDIES,

Cold Regions Research and Engineering Lab., Hanover, N. H. For primary bibliographic entry see Field 02C. W72-01397

THE RESISTOGRAPH AND THE COMPRES-SIVE STRENGTH OF SNOW.

Montana State Univ., Bozeman. Dept. of Earth

For primary bibliographic entry see Field 02C.

W72-01402

DEPTH TO GROUND-WATER TABLE BY REMOTE SENSING,

Oklahoma State Univ., Stillwater. Dept. of Civil Engineering M. Abdel-Hady, and H. H. Karbs.

ASCE Proceedings, Journal of the Irrigation and Drainage Division, Vol 97, No IR3, Paper 8360, p 355-367, September 1971. 7 fig, 1 tab, 10 ref.

Descriptors: \*Soil moisture, \*Water table, \*Remote sensing, Infrared radiation, Solar radiation, Surveys, Mapping, Photogrammetry, Temperature. Identifiers: \*Infrared imaging.

Infrared imagery was tested as a technique for remote sensing and surveying depth to the ground-water table. The variation of soil radiant energy in the 8-14 micron infrared spectral band is affected by depth to groundwater table. Differences in depth to groundwater table, within the 0 ft to 4 ft level, in 2 types of soils tested, were detectable by ground surface radiance measurements. During the period of investigation (summer), radiant intensity was maximum from 2 p m - 4 p m. Maximum radi-ant intensity differences resulting from variations to depth of water table also occurred during this period. The differences in radiance during the peak period were significant, suggesting excellent potential applications of most good imaging systems in detecting and surveying depth to groundwater table and soil moisture variations. (Knapp-USGS) W72-01420

INFORMATION GUIDE HYDROMETEOROLOGICAL INSTRUMENTS AND OBSERVATION METHODS (INFORMAT-SIONNYVE MATERIALY GIDROMETEOROLOGICHESKIM PRIBORAM I METODAM NABLYUDENIY).

Scientific Research Inst. of Hydrometeorological Instruments, Moscow (USSR). For primary bibliographic entry see Field 02B. W72-01550

A NEW METHOD FOR APPROXIMATE DETERMINATION OF AQUIFER PERMEABILITY (NOVYY METOD PRIBLIZHENNOGO OPREDELENIYA VODOPROVODIMOSTI VODONOSNYKH GORIZONTOV),

Kiev State Univ. (USSR). For primary bibliographic entry see Field 02F. W72-01551

STUDIES OF CARLSON STRESS METERS IN CONCRETE.

Bureau of Reclamation, Denver, Colo. For primary bibliographic entry see Field 08F. W72-01579

EXPERIENCE THROUGHOUT THE WORLD WITH THE CSIR DOORSTOPPER ROCK STRESS MEASURING EQUIPMENT, National Mechanical Engineering Research Inst.,

Pretoria (South Africa).
For primary bibliographic entry see Field 08E.
W72-01581

CONSTRUCTION MATERIALS IN DELTA

AREAS, Army Engineer Topographic Labs., Fort Belvoir,

D. G. Orr, and J. R. Quick. Photogrammetric Engineering, Vol 37, No 4, p 337-351, Apr 1971. 14 p, 8 fig, 5 ref.

Descriptors: \*Construction materials, \*Deltas, \*Remote sensing, Radar, \*Locating, Infrared photography, Sensors, \*Aerial photography, photography, Sensors, \*Aerial photography, Planning, Soil moisture, Soil temperature, Color photography, Land forms, Sands, Analytical techniques, Photogrammetry, Analysis, Gravels, Sand bars, Materials, Radar equipment, Geomorphology.
Identifiers: Mississippi Delta, Radar images, Gravel

beds. Infrared imagery.

Remote sensing techniques for identifying materials for engineering construction are most effective using a 2-phase procedure: a regional analysis, followed by a detailed analysis. Procedures for identifying likely sources of materials for engineering construction with multispectral remote sensor were applied to a part of the Mississippi Delta. Sensors included panchromaticolor and color-infrared photographs, thermal-infrared imagery, radar, 9channel multispectral scan imagery, and small-scale photo-index mosaics. Ground truth was acquired concurrently with the remote sensor overflights, and included soil mositure, soil temperasamples. The APO-97 is the most versatile radar system for regional analysis. Use of color-infrared photographs was preferable for detailed analysis in the delta environment. Thermal-infrared imagery provided useful information where applied in conjunction with photographs. The best potential sources of construction materials in this area were within the cheniers, point bars, riverbars and active beaches. (USBR) W72-01586

#### 7C. Evaluation, Processing and **Publication**

A MODEL FOR THE SIMULATION OF STREAMFLOW DATA FROM CLIMATIC

Monash Univ., Clayton (Australia). Dept. of Civil Engineering. For primary bibliographic entry see Field 02A. W72-01147

STRAIN NETWORKS ON THE MCMURDO ICE

Department of Scientific and Industrial Research, Wellington (New Zealand). Antarctic Div. For primary bibliographic entry see Field 02C. W72-01190

FLOOD WAVES FROM A CONTROLLED BREACHED DAM.

Missouri Univ., Rolla. Dept. of Civil Engineering. For primary bibliographic entry see Field 08D. W72-01335

POTENTIC ARTESIAN OF POTE 1969, FL FLORIDA FLORIDA Geological J. W. Stewa G. L. Faulk Available f D C 202 Hydrologic sheet, I ma

Descriptors fluctuations wells, Hydi vation wells Identifiers: Managemen

Potentiome Water Man base map, s change or period are potentiome hydrograph changes and by color par of the Flori District rangico to 120 f of the area to about 6 potentiome are centere (Lang-USG W72-01374

LOW-FLOY CAROLINE Geological S W. L. Yonts North Card Resources F 5 tab, 3 ref.

Descriptors: \*Discharge Average flo Flow rates Statistics, St Identifiers: Graphical co

More than prior to Jan streams in graphical co determining flow site usi tinuous-reco described a and the ann be expected vals are liste tions that ca USGS) W72-01379

WATER RE PART 1. S Geological S

Geological S I fig.

Descriptors: \*Surface wa tions, Stream ment, Lake discharge, D Identifiers: flow basic da POTENTIOMETRIC SURFACE AND AREAS OF ARTESIAN FLOW, MAY 1969, AND CHANGE OF POTENTIOMETRIC SURFACE 1964 TO 1969, FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT. FLORIDA.

Geological Survey, Washington, D.C.
J. W. Stewart, L. R. Mills, D. D. Knochenmus, and

G. L. Faulkner.

Available from US Geological Survey, Washington D C 20242 Price \$1.00. Geological Survey Hydrologic Investigations Atlas HA-440, 1971. 1 sheet, 1 map.

Descriptors: \*Potentiometric level, \*Water level fluctuations, \*Florida, \*Confined water, Artesian wells, Hydrograph analysis, Water measurement, Groundwater movement, Data collections, Observation wells.

Identifiers: \*Floridan aquifer, Southwest Water Management District (Fla), Long-term records.

Potentiometric contours of the Southwest Florida Water Management District are shown on a USGS se map, scale 1:500 000, and areas of decline, no change or rise of water levels during the record period are given in various colors. The change in period are given in various colors. The change in potentiometric surface, 1949-1969, is shown by hydrographs of selected wells, and the various changes and range in amount of changes are shown by color patterns on a smaller map. The water level of the Floridan aquifer in the Water Management District ranges from sea level near the Gulf of Mexico to 120 ft above sea level in the east-central part of the area. Changes in potentiometric surface 1949-69 for the entire area range from no decline to about 60 ft of decline. Areal declines of the potentiometric surface 1964-69 of more than 20 ft are centered about 35 mi east of Tampa Bay. (Lang-USGS) W72-01374

## LOW-FLOW MEASUREMENTS OF NORTH CAROLINE STREAMS, Geological Survey, Raleigh, N.C.

W. L. Yonts.

North Carolina Department of Water and Air Resources Report, July 1971. 236 p, 2 fig, 3 plate,

Descriptors: \*Streamflow, \*Low flow, \*Base flow, \*Discharge measurement, \*North Carolina, Average flow, Hydrologic data, Data collections, Flow rates, Stream gages, Gaging stations, Statistics, Statistical methods.

Identifiers: \*Base-flow measurements (NC), Graphical correlation.

More than 7,500 low-flow measurements made prior to January 1, 1969, at about 2,250 sites on streams in North Carolina are tabulated. The graphical correlation techniques and methods for determining low-flow characteristics for the lowflow site using the simultaneous low flow at continuous-record gaging stations (index stations), are described and illustrated. The average discharge and the annual minimum 7-day averages that may be expected to recur at 2-, 10-, and 20-year intervals are listed for 87 continuous-record gaging stations that can be used as index stations. (Woodard-W72-01379

### WATER RESOURCES DATA FOR TEXAS, 1970 - PART 1, SURFACE WATER RECORDS. Geological Survey, Austin, Tex.

Geological Survey Basic-Data Report, 1971. 613 p, I fig.

Descriptors: \*Hydrologic data, \*Data collections, \*Surface waters, \*Streamflow, \*Texas, Gaging stations, Stream gages, Flow rates, Flow measurement, Lakes, Average flow, Low flow, Peak discharge, Discharge measurement.

Identifiers: \*Water resources data (Tex), Streamflow basic data

Surface-water records for the 1970 water year for Texas, including records of streamflow or reservoir storage at gaging stations, partial-record stations, and miscellaneous sites, are presented. Records for a few pertinent gaging stations in bordering states are also included. The tables of data include a are ano included. Includes of data include a description of the gaging station, and daily, monthly, and yearly discharges of the stream. The description of the station gives the location, drainage area, records available, type and history of gage, average discharge, extremes of discharge, and general remarks. For most gaging stations on lakes and reservoirs, a description of the station and a monthly summary table of stage and contents discharge measurements at low-flow partial-record stations, and annual maximum stage and discharge at crest-stage stations. (Woodard-USGS) are given. Data for partial-record stations include

## GEODETIC RESULTS OF THE ROSS ICE SHELF SURVEY EXPEDITIONS, 1962-63, AND

Technische Universitaet, Brunswick (West Germany). Dept. of Photogrammetry and Cartog-

raphy. For primary bibliographic entry see Field 02C. W72-01381

# COMPUTER PROGRAMS IN USE IN THE WATER QUALITY DIVISION, VOL. 2, Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

A. Demayo.

Canada Department of Energy, Mines and Resources Inland Waters Branch Report Series No 14, 1971. 40 p, 19 fig, 7 tab, 18 ref.

Descriptors: \*Data processing, \*Data storage and retrieval, \*Computer programs, \*Water quality, \*Water analysis, Chemical analysis, Systems analysis, Digital computers, Hydrological data, Data collections, Statistics, Water chemistry. Identifiers: \*Canada.

The computer programs in use in the Canadian Water Quality Division are described. Included are the programs used to calculate the results of chemical analysis of water, the programs used to type out a complete report of such an analysis and, a program used for calculating concentrations from a digitized recorder chart. These programs are used mainly to check the analytical results of chemical analysis of water. The parameters are listed in the order of input into the computer. The 23 parameters appearing in the output, the symbols denoting them, and the units in which they are expressed, are listed and discussed. (Woodard-USGS) W72-01426

#### DETERMINATION OF HYDRAULIC CONDUC-TIVITY--CAPILLARY PRESSURE RELATION-SHIP FROM SATURATION-CAPILLARY PRESSURE DATA FROM SOILS,

Utah Water Research Lab., Logan. For primary bibliographic entry see Field 02G. W72-01450

## USER'S GUIDE AND DOCUMENTATION FOR OUTFALL PLUME MODEL,

Environmental Protection Agency, Corvallis, Oreg. D. J. Baumgartner, D. S. Trent, and K. V. Byram. Available from the National Technical Information Service as PB-204 577, \$3.00 in paper copy, \$0.95 in microfiche. Working Paper No 80, May 1971. 2 fig. 4 ref, append. EPA Program 16070 GHV 05/71.

Descriptors: \*Computer programs, Computer models, Water pollution sources, Jets, Discharge (Water), \*Discharge measurement, Discharge lines, Waste dilution, Stratified flow.
Identifiers: \*Plumes, \*Pipeline discharges.

Many users have need for a computational program for analysis of pipeline discharges into lakes, reservoirs, estuaries, or the ocean. This computer program, PLUME, is offered as a standard procedure for analysis of industrial waste, thermal, and sewage streams, incorporating the most recent knowledge of jets and plumes generally applicable. W72-01491

### SEWER DESIGN AND COST ESTIMATION BY

COMPUTER, Regional Planning Council, Baltimore, Md. For primary bibliographic entry see Field 05D. W72-01508

#### 08. ENGINEERING WORKS

#### 8A. Structures

## METHODOLOGY FOR SYNTHESIS AND OP-TIMIZATION OF DIFFUSION PATTERNS IN

Illinoise Univ., Urbana. Dept. of Civil Engineering. For primary bibliographic entry see Field 08B. W72-01490

### SEWER DESIGN AND COST ESTIMATION BY

COMPUTER, Regional Planning Council, Baltimore, Md. For primary bibliographic entry see Field 05D. W72-01508

#### WATER RESOURCE PROJECTS OF THE CORPS OF ENGINEERS.

For primary bibliographic entry see Field 04A. W72-01675

#### 8B. Hydraulics

#### CHARACTERISTICS OF FLOW OVER WEIRS OF FINITE CREST WIDTH,

Indian Inst. of Tech., Kanpur. Dept. of Civil En-

gineering. Surya Rao, and M. K. Shukla.

ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY 11, Paper 8515, p 1807-1816, November 1971. 5 fig, 1 tab, 8 ref, append.

\*Weirs, \*Discharge (Water), \*\*Poischarge measurement, Hydraulics, Hydraulic structures, Reynolds number.
Identifiers: \*Broad-crested weirs.

The characteristics of flow over weirs of rectangular cross section with finite crest width depend on a characteristic Reynolds number, Weber number, head over the weir, height of the weir, width of the weir in the direction of flow, and roughness height of the weir surface. The ratios of head to height and width are the most important parameters, and a unified understanding of the whole family of weirs can be obtained by considering their variation. For weirs with a streamlined upstream corner, the ratio of the brink depth to the critical depth is close to 0.715. (Knapp-USGS)

### SIMPLIFIED PROCEDURE FOR EVALUATING SOIL LIQUEFACTION POTENTIAL, California Univ., Berkeley, Dept. of Civil Engineer-

H. B. Seed, and I. M. Idriss.

ASCE Proceedings, Journal of the Soil Mechanics and Foundations Division, Vol 97, No SM 9, Paper 8371, p 1249-1273, September 1971. 18 fig, 2 tab, 31 ref, append.

Descriptors: \*Earthquakes, \*Soil mechanics, \*Landslides, \*Mudflows, \*Soil dynamics, Soil physics, Mass wasting, Soil physical properties, tress, Strain. Identifiers: Soil liquefaction.

#### Field 08—ENGINEERING WORKS

#### **Group 8B—Hydraulics**

Field data concerning the liquefaction or nonliquefaction behavior of sands during earthquakes was assembled and compared with evaluations of performance using a simplified new procedure. Limited available field data can provide a useful guide to the probable performance of sand deposits. The proposed method of presenting data provides a useful framework for evaluating past experiences of sand liquefaction during earthquakes, and the simplified evaluation procedure provides a reasonably good means for extending previous field reasonary good means of the constraints of the cons

METHODOLOGY FOR SYNTHESIS AND OP-TIMIZATION OF DIFFUSION PATTERNS IN FLOW SYSTEMS.

Illinoise Univ., Urbana. Dept. of Civil Engineering.
W. Maxwell, C. Hall, and Chang Kuo-Cheng.
Available from the National Technical Information Service as PB-204 523, \$3.00 in paper copy \$0.95 in microfiche. Illinois Water Resources Center Research Report No 44, UILU-WRC-71-0044, August 1971. 46 p, 9 fig, 5 tab, 17 ref. A-046-ILL (1).

Descriptors: \*Boundaries (Surfaces), \*Diffusion, Flow characteristics, \*Flow profiles, \*Free sur-faces, Turbulence, Hydraulics, \*Jets, Temperature,

Identifiers: Free turbulence, Heat flux, Mass flux, Momentum flux.

This analytic study used a generalization of Reichardt's hypothesis by Alexander, Baron and Comings to develop a unified treatment for the synthesis of diffusion patterns for mass, heat and momentum. The technique was applied for coplanar and co-axial flows, to a study of the effects of initial flux distribution and outlet shape on diffusion patterns; and to shallow submerged outlets. Four simple approximations to the P-function, involving only exponential and error functions, were found to represent flux distributions downstream from a circular jet of finite size at all points between the nozzle and infinity. The results may be applied in the study and design of discharge outlets, syphon spillways, hydraulic breakwaters and diffusion of tracers in streams and penstocks. W72-01490

USER'S GUIDE AND DOCUMENTATION FOR OUTFALL PLUME MODEL, Environmental Protection Agency, Corvallis, Oreg.

For primary bibliographic entry see Field 07C. W72-01491

#### 8C. Hydraulic Machinery

INVESTMENT DECISION ON HYDROELEC-TRIC DEVELOPMENT, PART ONE,

Engineering and Power Development Consultants, Sidcup (England).

K. G. Armstrong. Water Power, p 68-73, February, 1971. 3 fig.

Descriptors: \*Electric power demand, \*Investment, \*Marginal costs, \*Estimated costs, On-site data collections.

Identifiers: \*Hydroelectric potential, \*Investment appraisal, Value of supply.

The main issues in appraising the need for expanding electrical supply are divided into three categories, those dealing with the most efficient use of national resources, those dealing with demand forecasting and those dealing with the evaluation of existing systems and decisions on hydroelectric development. Efficient use of national resources is determined by ascertaining the cost of resources used, evaluating the existing system and applying the principle steps in investment appraisal. In forecasting demand, the growth in peak demand seems likely to be more significant as a factor in hydroelectric development than growth in the de-mand for energy. Indicators of short-term demand are discussed. Before deciding to expand a given system the value of the existing one must be determined by using marginal costs of operation and transmission criteria. Expansion of a system involves the search for hydroelectric potential, preliminary cost estimation and design of alternative future systems. A method of comparing alternative systems is included. (See also W72-01353) (Dyer-Wisconsin) W72-01352

INVESTMENT DECISION ON HYDROELECTRIC DEVELOPMENT, PART TWO, Engineering and Power Development Consultants,

Sidcup (England). K. G. Armstrong. Water Power, p 109-114, March, 1971. 1 fig, 1 tab,

tion analysis

29 ref. Descriptors: \*Hydroelectric plants, \*Decision making, \*Investment, Financial analysis, Data collections, Marginal costs, Total costs, Risks, Simula-

A rational process for making hydroelectric invest-ment decisions is developed. Data collection plays a crucial role in the decision process, and should be efficient and comprehensive. A check list for basic data includes the energy environment, site particulars, typical costs, current technical knowledge, management affairs, taxes, sources of capital, and conditions of procurement. Next in the decision process is the determination of an optimum works layout. The works layout resolves conflicts in the major economics of water storage, plant capacity, and river-flow control. It integrates the economics of construction, plant and material purchases, and completed station operations. For instance, an economic site layout provides means of quick and easy access for all movements, and it will be designed around construction operations as well as the permanent works. The optimum layout will be identified as that layout from which any variations would increase the cost of electricity supply. Rational decision-making also requires detailed cost estimates, and a financial appraisal of the project may be necessary. Typically such appraisals utilize

## GROUND CURRENT RETURN ELECTRODE

a simulation model. The effect of uncertainty on

the decision-making process and methods for in-cluding uncertainty in the analysis are also con-sidered. (See also W72-01352) (Settle-Wisconsin) W72-01353

Teshmont Consultants Ltd., Winnipeg (Manitoba); and Manitoba Hydro.

R. K. Shemie, and D. S. Simons.

Paper, Manitoba Power Conference on EHV-DC,
Winnipeg, Can, June 1971. 31 p, 9 fig, 2 tab, 9 ref.

Descriptors: \*Electrodes, \*Ground return, \*Direct Descriptors: "Electrodes, "Oround return, "Direct current, Ground currents, Transmission (Electri-cal), "Transmission lines, Electric current, Test results, Site selection, Stray current corrosion, Thermal conductivity, Pipelines, Foreign design practices, Soil resistivity, Current density, Tem-

perature rise, High voltage.
Identifiers: Coke, \*Bipolar transmission lines,
Canada, Nelson River, Canada, Potential gradients.

The Nelson River Transmission System uses plus or minus 450 kv bipolar HVDC circuits of overland transmission lines requiring earth electrodes to carry the normal out-of-balance d-c current and, during transient and emergency monopolar opera-tion, the full load current of 1800 amps. The criteria for location, ratings and design of the circular electrodes are examined and compared with the results of a pilot electrode test program. Results of measurements made on buried pipelines and on other installations during the pilot tests indicate no adverse effect on these installations from ground return currents injected into the earth at the

selected sites. The site selection and pilot electrode test program are discussed and the results tabu-lated. The electrode design will achieve an esti-mated resistance of 0.4 ohm for both Dorsey and Radisson. (USBR) W72-01576

CONSTRUCTIONAL ASPECTS OF THE PLUS OR MINUS 450 KVDC NELSON RIVER TRANS-MISSION LINE,

Teshmont Consultants Ltd., Winnipeg (Manitoba).

Papter, Manitoba Power Conference on EHV-DC, Winnipeg, Can, June 1971. 28 p, 7 fig, 2 tab.

Descriptors: \*Transmission lines, \*Construction, \*Permafrost, Muskeg, Guyed towers, Foundations, Transportation, Peat bog, Access roads, Radio communication systems, Scheduling, Transmission towers, Helicopters, Foreign design practices, Stringing, Bundled conductors, \*Cold weather construction, \*Appended towers\* Colineary\*

struction, Anchored towers, Caissons.
Identifiers: \*Bipolar transmission lines, Canada, Nelson River, Canada, Mat foundations, Rock footings, Self-supporting towers.

The Nelson River Transmission Line connects the Radisson Converter Station, near the source of power generation on the Nelson River, and the Dorsey Converter Station near Winnipeg. Two bipolar, plus or minus 450-kv d-c, lines, each 556 mi long, are located on the same right-of-way. The northern 250 mi of line presented serious access problems because much of the line runs through problems because much of the line runs through muskeg and peat bogs, passable only when frozen. Materials reached this area by the Canadian Na-tional Railway, 15 to 40 mi distant from the line right-of-way. Helicopters and fixed-wing aircraft were used extensively to gain access to this section of line. Construction behalving was complicated of line. Construction scheduling was complicated because much of the work could be accomplished only during winter months. Communication was mostly by VHF and HF radio systems. Construction of tower foundations, guy anchors, towers, string-ing and sagging of conductors, transportation problems, and natural environment are discussed.

Considerable advances in the technology of transmission line construction in permafrost areas resulted from this project. (USBR) W72-01577

SINGLE LINE DIAGRAM OF THE NELSON RIVER HVDC TRANSMISSION SYSTEM,

Teshmont Consultants Ltd., Winnipeg (Manitoba). R F Harrison Paper, Manitoba Power Conference on EHV-DC, Winnipeg, Can, June 1971. 19 p, 4 fig, 9 ref.

Descriptors: \*Transmission lines, \*Direct current, Economics, Bundled conductors, Reliability, Converters (Electrical), Electrical faults, \*Transmission (Electrical), Switchyards (Electrical), Conversion (Electricai), Switchyards (Electricai), Conversion, Line switching, Automatic control, Performance, Foreign design practices, Alternating current, Transmission loss, Design criteria. Identifiers: Canada, Nelson River, Canada, \*Bipolar transmission lines, Outages.

The a-c and d-c single line diagrams of the Nelson River plus or minus 450-kv HVDC Transmission System are examined and the choice of electrical arrangements, design criteria, and functions of the main components are explained. The Nelson River Project, delayed for many years because of its distance from load centers, is a point-to-point type d-c transmission scheme, and has a higher transmission voltage than any existing scheme in the world. Unique features permit remote control of both converter stations. The transmission system was designed for the high availability and reliability necessary for an important bulk power transmis-sion link. Special features include automatic sequencing to clear faulted a-c or d-c equipment to reduce outrage time. Special attention was given to the reliability of auxiliary power systems, particu-larly their ability to ride through system disturbances, and provide remote restart of auxiliaflexibility required, was an im d-c vs a-c and overle ductor bi W72-0157

INSULAT SCHEMES Allmanna : A Johanse Paper, Ma Winnipeg,

Descriptor verters (El trical), Th practices, sulation, C surges, Ele entifiers: Sweden, Li

The insula equipment cuitry, the thorough ir scheme and for protect necessary system. Th type of con tive equipm design and are reviewe onverter to valve chose overvoltage considered ity to consi (USBR) W72-01583

CONTROL THE NELS JECT, Teshmont C and English A. A. Burro Paper, Mani Winnipeg Ca

Descriptors: \*Transmissio (Electrical). Protection Electrical fa Line switchin dentifiers: Nelson River

The perform

upon the rel tive features cised by the Transmission. how these re system cont scussed. Th ble to manua scheme. The system distur ency failure have been d minimal. Red however, care vantages of re

#### Rock Mechanics and Geology—Group 8E

ries after a system shutdown. The d-c system has flexibility for growth by adding valve groups, as required, to increase capability, a feature which was an important economic factor in the choice of d-c vs a-c transmission. Based on loss evaluation and overload requirements, a twin 1.6-in.-dia conductor bundle (USBR) was selected for the d-c line W72-01578

#### INSULATION COORDINATION OF HVDC SCHEMES.

nanna Svenska Elektriska A. B., Ludvika A. Johansson, K. A. Eriksson, and G. Flisberg.
Paper, Manitoba Power Conference on EHV-DC, Winnipeg, Can, June 1971. 17 p, 8 fig, 1 tab, 5 ref.

Descriptors: \*Direct current, \*High voltage, \*Converters (Electrical), Reliability, \*Protection (Electrical), Thyristors, Conversion, Foreign design practices, Transmission (Electrical), \*Electrical insulation, Coordination, \*Overvoltage, Switching surges, Electrical faults, Alternating current. Identifiers: \*Solid-state valves, Solid state devices, Sweden, Lightning surges.

The insulation requirements of HVDC terminal equipment greatly influence the converter cir-cuitry, the reliability of operation, and the installa-tion costs. An insulation coordination based on a thorough investigation of overvoltages in a specific scheme and careful examination of the conditions for protective devices and converter equipment is necessary to obtain an optimized transmission system. The effect on insulation coordination requirements of the main circuit arrangements, type of converter equipment selected, and protective equipment, is discussed. Basic methods of insulation coordination established and verified during design and construction of existing HVDC schemes are reviewed. Many of the basic concepts of the converter techniques are unaffected by the type of valve chosen. The type of valve used influences the overvoltage protection arrangements and must be considered for insulation coordination. The necessity to consider the specific qualities of both ionic and semiconductor valves is demonstrated. (USBR) W72-01583

#### CONTROL AND PROTECTION ASPECTS OF THE NELSON RIVER TRANSMISSION PRO-JECT,

Teshmont Consultants Ltd., Winnipeg (Manitoba); and English Electric Power Transmission Ltd. A. A. Burrow, and B. Rowe.

Paper, Manitoba Power Conference on EHV-DC, Winnipeg Can, June 1971. 30 p, 6 fig, 9 ref.

Descriptors: Electric power, \*Control systems, \*Transmission lines, \*Direct current, \*Converters (Electrical), Reliability, Alternating, Current, \*Protection (Electrical), Switchyards (Electrical) Electric power failure, Thyristors, Conversion, Electrical faults, Foreign design practices, Safety, Line switching, \*Automatic control. Identifiers: Canada, \*Bipolar transmission lines, Nelson River, Canada, Solid-state valves.

The performance of a transmission system depends upon the reliability of its components, the protective features built in to guard it against internal and external faults, and the quality of supervision exercised by the system controls. The Nelson River Transmission System reliability requirements, and how these requirements are met in the design of system control and protective features, are discussed. The use of automatic controls is preferable to manually activated sequences in a complex scheme. The whole scheme is designed to minimize system disturbances resulting from a single continency failure. The control and protective systems gency failure. The control and participation have been decentralized so that the amount of equipment affected by any single failure will be minimal. Redundancy in key areas is freely applied; however, care was exercised to ensure that the advantages of redundancy were not lost by a failure to segregate redundant equipments from each other. Control and protection for a-c and d-c switchyards, interlock systems, power flow, pole current, converters, and valve groups are discussed. (USBR) W72-01584

## NELSON RIVER HVDC TRANSMISSION LINE FOUNDATION DESIGN ASPECTS, Teshmont Consultants Ltd., Winnipeg (Manitoba).

Paper, Manitoba Power Conference on EHV-DC, Winnipeg, Can, June 1971. 15 p, 5 fig, 5 ref.

Descriptors: \*Guyed towers, Descriptors: "Guyed towers, "Transmission towers, "Footings, Muskeg, "Permafrost, "Foundations, Foundation investigations, Frost action, Ice lenses, Frost heaving, Auger-type footings, Anchors, Foreign design practices, Field tests, Soil mechanics, Differential settlement, Strain measure-

ment, Caissons, Profiles.
Identifiers: Canada, Bipolar transmission lines, Nelson River, Canada, Mat foundations, Self-support-

The 556-mi-long double-circuit transmission line required construction of footings for 3918 guyed towers and 96 self-supporting major angle towers. A variety of foundation conditions were encountered: rock with widely varying surface elevations, deep muskegs, discontinuous permafrost, soft clays, boulder tills and ground subject to seasonal frost heave. At some tower sites only part of the ground was affected by permafrost. Thawing of permafrost caused differential ground settlement ithin a tower site of 6 to 14 in. and in some areas as much as 3 ft. Heaving forces caused by ground adfreeze to structures varied between 4800 psf at ground level to 800 psf at a depth of 6 ft. The relation of the characteristics of discontinuous permafrost and the assessment of frost adfreeze forces overburden drilled-type guyed tower anchor, em-bodying a new concept for transmission lines, was designed to meet the varying soil conditions. (USBR) W72-01585

#### ADVANCED CONCEPTS OF HOLOGRAPHIC NONDESTRUCTIVE TESTING,

GCO, Inc., Ann Arbor, Mich. For primary bibliographic entry see Field 08G. W72-01589

#### 8D. Soil Mechanics

#### FLOOD WAVES FROM A CONTROLLED BREACHED DAM,

Missouri Univ., Rolla. Dept. of Civil Engineering.

T. E. Harbaugh, and D. L. Fread. Available from the National Technical Information

Service as PB-204 493, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, August 1971. 52 p, 14 fig, 1 tab, 33 ref, 3 append. OWRR A-035-MO (1).

Descriptors: \*Earth dams, Hydraulics, Mathematical models, \*Reservoirs, \*Open-channel flow, \*Unsteady flow, Dams, Flow, Spillway crests, \*Simulation analysis, Erosion control, Equations. Identifiers: \*Spillway design, Floor frequency, \*Breached dams, Overtopping, Erosion retarding layers. Flood waves.

A conceptual method to alleviate flood damages due to overtopping failures of small earthfill dams is the incorporation of a relatively thin erosion re-tarding layer within the dam. This paper in-vestigates the reduction in the reservoir release due to the hypothetical erosion retarding layer. The paper also provides a method for the determination of an optimal location of the layer so as to minimize the maximum possible reservoir release due to a gradually breached earth dam. The transient reservoir flow is simulated by a numerical model, based upon the solution of the one-dimensional St. Venant unsteady open-channel flow equations. These equations are solved by the method of characteristics, with appropriate boundary conditions incorporated into the solution procedure. The numerical simulation model is used to determine the reduction in reservoir release due to a single retarding layer and its optimal location for a wide range of pertinent geometric, hydraulic and dynamic parameters. The sensitivity of the results to variations in the above parameters is discussed. W72-01335

### ON-SITE INVESTIGATIONS OF INFILTRA-TION (NATURNYYE ISSLEDOVANIYA FIL'-TRATSID.

For primary bibliographic entry see Field 02G. W72-01552

## DEFORMABILITY, STRENGTH, AND CREEP ON CLAYEY-SOIL CORE WALLS OF HIGH DAMS,

Moskovskii Inzhenerno-Strotelnyi Institut (USSR). G. M. Lomize.

Hydrotechnical Construction, No 11, p 1027-1035, Nov 1970. 9 p, 14 fig, 3 tab, 7 ref.

Descriptors: \*Clays, Soil mechanics, \*Soil investigations, Soil plasticity, Consolidation, Soil strength, Soils, Creep, Dams, \*Earth dams, \*Stress analysis, Deformation, Dam construction, Cores, Loads (Forces), Foreign research.
Identifiers: \*Deformable soils, USSR.

The clayey soil of the core walls of high dams in an elastic, viscous, plastic medium with predominantly plastic deformations. Consequently, evaluation of the operating conditions of such soils in dams must be based on theories of plasticity, creep, consolida-tion, and strength, to describe the initial equation of the stress-deformation state, and should give computational solutions of the deformation and stress state of the core walls for various stages of its operation. Solutions are not yet available for this problem. Basic results of investigations of complex loading trajectories and creep are presented, representing a stage in the solution of the problem. The investigations demonstrate that in computa-tions of the deformability and strength of clay core walls of high dams, based on methods of deformation-plasticity theory, it is obligatory to take into account the spatial stress state of various types and the simple to complex loading trajectories accompanied by variation of the stress state and by rota-tion of the principal-stress axis. Complex loading and trajectories with rotation of the axes prevail during the period of filling the reservoir. The creep investigations confirm the significant effect of nonstationary processes on the functioning of dam core walls, their deformability, and strength. (USBR) W72-01580

## CONSTRUCTION MATERIALS IN DELTA

Army Engineer Topographic Labs., Fort Belvoir, For primary bibliographic entry see Field 07B. W72-01586

#### 8E. Rock Mechanics and Geology

# A FINITE DIFFERENCE METHOD FOR ANALYZING LIQUID FLOW IN VARIABLY SATURATED POROUS MEDIA, Corps of Engineers, Davis, Calif., Hydrologic En-

gineering Center. R. L. Cooley.

Army Corps of Engineers Hydrologic Engineering Center, Technical Paper No 22, 1970. 42 p, 3 fig, 2 tab, 30 ref, append. Davis, Calif., Hydrologic En-

Descriptors: \*Groundwater movement, \*Porous media, \*Model studies, Saturated flow, Hydraulic

#### Field 08-ENGINEERING WORKS

#### Group 8E-Rock Mechanics and Geology

conductivity, Porosity, Transmissivity, Aquifer characteristics, Hydrogeology, Mathematical models, Equations, Viscosity, Water table, Rock properties, Analytical techniques, Methodology.

Finite difference equations were derived by converting the original nonlinear partial differential equation to an integral equation using the divergence theorem and integrating around individual mesh volumes. Application of the technique to the problem of axi-symmetric flow to a water well partially or completely penetrating an elastic uncon-fined aquifer demonstrates the use of the technique. Three methods were used to solve the matrix equations resulting from the scheme: a form of the direct alternating direction implicit method (ADIP), the iterative alternating direction implicit method (ADIPIT), and line successive over-relaxation (SLOR). The fastest method for the problems investigated so far was SLOR. The number of iterations required for SLOR and ADIPIT were similar, but ADIPIT requires two mesh sweeps per iteration. Excessively small time steps were required for convergence of ADIP. Original nonlinearity of the differential equation was preserved by keeping saturations and relative permeabilities current with hydraulic heads in the iteration sequence, then averaging them over time. The mesh integration method appears to be well suited for application to regions having internal boundaries between subregions of different rock properties because it directly utilizes the boundary conditions acting at the interfaces. (Woodard-USGS)

EXPERIENCE THROUGHOUT THE WORLD WITH THE CSIR 'DOORSTOPPER ROCK STRESS MEASURING EQUIPMENT,

National Mechanical Engineering Research Inst., Pretoria (South Africa).

E. R. Leeman. Proceedings, Second Congress International Society on Rock Mech, Vol 2, Themes 3-4, p 419-425, Belgrade, Yugoslavia, September 1970. 7 p, 6 fig. 23 ref.

Descriptors: Measuring instruments, Rock tests, Rock mechanics, Foreign products, \*Strain measurement, \*Strain, \*Boreholes, Stress, Strain me-ters, Electrical resistance, Stress relieving, \*Geologic investigations, Worldwide, Assessments, Bibliographies.

Identifiers: \*Doorstoppers, Rosette, Deformation meters, South Africa.

The CSIR (South African Council for Scientific and Industrial Research) doorstopper rock stress measuring equipment was developed 5 years ago and has become commercially available during the past 3 years. Doorstoppers have been used worldwide. An assessment is made of the published results obtained throughout the world in rock stress measuring with the doorstoppers in many types of rock and under varied field conditions. The versatility and potential of this type of equipment are evident from this assessment. (USBR) W72-01581

THE STRESSES AROUND OPENINGS IN

Canterbury Univ., Christchurch (New Zealand)

J. P. Blakeley. New Zealand Engineering, Vol 26, No 4, p 105-110, Apr 1971. 6 p, 5 fig, 9 ref.

Descriptors: \*Rock mechanics, \*Underground structures, \*Stress underground powerplants, Underground openings, Tangential stress, Radial stress, In situ rock, In situ tests, Rock properties, Foreign research, Deformation, Rock pressures, Mathematical analysis, Finite element method, Analysis, Rock bolts, Tunnel linings, Stress analy-Identifiers: New Zealand, Photoelastic analysis.

In the past decade several underground powerplants have been built in many parts of the world. In some countries large underground openings have been constructed for defense works. Many tunnels are built each year. The rock mechanics principles applicable to the design of all types of underground structures is reviewed. The initial state of stress in the rock mass is either assumed or must be determined experimentally. Elastic theory is then used to determine the change of stress resulting from the creation of the opening. The need for rock support around the opening can be evaluated if the strength properties of the in situ rock are known. Methods of rock support are discussed. (USBR) W72-01588

#### 8F. Concrete

STUDIES OF CARLSON STRESS METERS IN CONCRETE. Bureau of Reclamation, Denver, Colo.

K. B. Hickey.

Bureau of Reclamation Report No. REC-ERC-71-19, Apr 1971. 23 p, 24 fig, 5 tab, 6 ref.

Descriptors: \*Pressure measuring instruments, \*Stress meters, Mass concrete, Instrumentation, \*Concrete technology, Meters, Gages, Strain, Pressure sensors, Volume change, Strain gages, Residual stress, Stress, Compressive strength, Modulus of elasticity, Strain meters, Accuracy, Laboratory tests, Loading tests, Concretes, Performance tests.

Identifiers: \*Carlson stress meter, Carlson strain meter, \*Internal stress, End restraint.

Investigations have been made to determine the effects of changes in temperature, moisture, and applied load on stresses indicated by Carlson stress meters embedded in concrete. Carlson stress meters, strain meters, and resistance thermometers were embedded in and external strain and temperature reading points were attached to the surface of three 18- by 36-in. concrete test cylinders. The cylinders were subjected to: drying, remoistening, and stable moisture conditions; temperatures from 20-115 deg F; and compressive loads to 700 psi. Load tests at constant temperatures show that stresses indicated by the stress meters are accurate to within 7% of the applied stress when load pads are used to reduce end restraint of the specimens. Accurate temperature correction factors for the stress meters could not be established because exact effects of temperature changes on stress reorientations in part-dry concrete could not be determined by the study procedures used. Stresses produced by drying, stress relief during storage and upon remoistening, strains, and strength and elastic modulus at various moisture conditions of the concrete are discussed. (USBR) W72-01579

#### 8G. Materials

PLASTIC LINER REPAIRS LEAKING SEWER, San Mateo City Engineers Office, Calif. For primary bibliographic entry see Field 05D. W72-01507

PLASTIC RELINING OF SMALL-DIAMETER

Toronto Dept. of Public Works (Ontario). For primary bibliographic entry see Field 05D. W72-01511

ADVANCED CONCEPTS OF HOLOGRAPHIC NONDESTRUCTIVE TESTING, GCO, Inc., Ann Arbor, Mich.

Descriptors: \*Nondestructive tests, \*Interferome-Descriptors: "Nondestructive tests, "Interferometers, Transducers, Optical instruments, "Tests, Laminates, Inspection, "Materials tests, Thermal stress, Vibration, Vibration tests, Hydraulic turbines, "Test equipment, Measuring instruments, Instrumentation, Research and development. Identifiers: "Holography, Sandwich construction, Honeycomb construction.

Holographic interferometry has proven useful for nondestructive testing of a large class of objects. New and advanced optical techniques show promise of greatly extending the capability of holo-graphic interferometry as a nondestructive testing tool. New optical techniques are used to examine laminate structures with greater resolution and flaw laminate structures with greater resolution and flau detectability. These new techniques greatly increase the inspection speeds of holographic non-destructive testing. In the area of vibrational analysis with holographic interferometry, a technique has been developed which allows the detection of vibrational amplitudes in the order of 10 to the minus 7 power to 10 to the minus 8 power cm. The ability of optical holography to record the vibrational patterns of a vibrating object and measure their surface displacements to several millionths of their surface displacements to several millionths of a centimeter has greatly assisted engineers in the design of structures from high-power mechanical transducers to turbine blades. (USBR) W72-01589

#### 09. MANPOWER, GRANTS AND FACILITIES

#### 9D. Grants, Contracts, and Research Act Allotments

INTERNATIONAL, REGIONAL, FEDERAL-STATE, INTERSTATE AND FEDERAL OR-GANIZATIONS WITH WATER AND RELATED LAND RESOURCES PROGRAMS IN MIN-NESOTA, 1971,

Minnesota Univ., Minneapolis. Water Resources

Research Center. For primary bibliographic entry see Field 06E. W72-01328

#### 10. SCIENTIFIC AND TECHNICAL INFORMATION

STUDY AND UTILIZATION OF THE WATER RESOURCES OF THE USSR, 1966-1967, (IZUCHENIYE I ISPOL'ZOVANIYE VODNYKH RESURSOV SSSR, 1966-1967 GG.). Akademiya Nauk SSSR, Moscow. Inst. of Water

For primary bibliographic entry see Field 02A. W72-01549

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### CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U. S. Geological Survey, U. S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the Soap and Detergent Association and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Public Work Supply Treatment Technology at the American Water Works Association.

### Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural livestock wastes at the Department of Agricultural Engineering of Iowa State University.
- Methods for chemical and biological identification and measurement of pollutants at the Analytical Quality Control Laboratory of the Environmental Protection Agency.
- Coastal pollution at the Oceanic Research Institute.
- Water treatment plant waste pollution control at American Water Works Association Research Foundation.

### **Subject Fields**

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- 2 WATER CYCLE
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- WATER QUANTITY MANAGEMENT
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